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THE UNIVERSITY OF ALBERTA

Nearctic Scythrididae (Lepidoptera: Gelechioidea): Synopsis of described species, revision of selected genera, and phylogenetic analysis of structural characters

by

©

Jean-François Landry

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF Doctor of Philosophy

Department of Entomology

EDMONTON, ALBERTA

Spring 1988

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ISBN 0-315-42865-1

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DEGREE FOR WHICH THESIS WAS PRESENTED Doctor of Philosophy

YEAR THIS DEGREE GRANTED 1988

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(SIGNED) Jean François Landry

PERMANENT ADDRESS:

Agriculture Canada
Biosystematics Research Center, K.W. Neatby
Bldg., C.E.F., Ottawa, Ontario K1A 0C6

DATED January 28, 1988

THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled Nearctic Scythrididae (Lepidoptera: Gelechioidea): Synopsis of described species, revision of selected genera, and phylogenetic analysis of structural characters submitted by Jean-François Landry in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

Geo. E. Ball

Supervisor

Mark V. H. Wilson

B. S. Heming

John Addicott

Don R. Davis

External Examiner

Date January 28, 1988

ABSTRACT

A review of all previously described Nearctic species of Scythrididae reveals 31 species. The following nomenclatural changes are proposed: *Scythris immaculatella* (Chambers), *S. matutella* (Clemens), *S. brevistrigella* (Chambers) and *S. dorsipallidella* (Chambers) are removed from synonymy with *S. impositella* (Zeller); *S. planipenella* (Chambers) is the valid name of the nominal species previously cited as *S. plausipennella* (Chambers). The following new synonymy is proposed: *S. pacifica* McDunnough = *S. immaculatella* (Chambers); *S. fuscicomella* (Clemens) = *S. eboracensis* (Zeller); *S. aterrimella* (Walker) and *S. epilobiella* McDunnough = *S. inspersella* (Hübner); *S. magnatella* Busck and *S. noricella latifoliella* Wolff = *S. noricella* (Zeller); *S. albacostella* (Chambers), *Coleophora fuscostrigella* Chambers and *S. hemidictyas* Meyrick = *S. planipenella* (Chambers). *Coleophora inornatella* Chambers is transferred from the Coleophoridae to the Scythrididae as *S. inornatella* (Chambers), new combination. The generic names *Arotrura* Walsingham and *Colinita* Busck and the original combinations *A. eburnea* Walsingham and *C. sponsella* Busck are re-established as valid. *S. divaricata* Braun is added to the american fauna north of México. Four nominal species remain unrecognized: *Sythris albilineata* (Walsingham), *S. brevistrigella* (Chambers), *S. dorsipallidella* (Chambers) and *S. pilosella* (Zeller). *S. albapenella* (Chambers) is transferred to the Blastobasidae and *S. arizoniella* (Kearfott) is transferred to the Coleophoridae (with a lectotype designated).

A diagnosis and description of adult structural characters of the family are presented. The Nearctic genera of Scythrididae are revised selectively. Fourteen genera are recognized (type species of new genera in brackets): *Scythris* Hübner; *Rhamphura* n. gen. [*R. ochristriata* (Walsingham), n. comb.]; *Areniscythris* Powell; *Asymmetrura* n. gen. [*A. impositella* (Zeller), n. comb.]; *Neoscythris* n. gen. [*N. fissirostris* (Meyrick), n. comb.]; *Colinita* Busck; *Hyalinixys* n. gen. [*H. sinuosa* n. sp.]; *Meniscotus* n. gen. [*M. balli* n. sp.]; *Arotrura* Walsingham; *Aeciatus* n. gen. [*A. formidabilis* n. sp.]; *Mimiella* n. gen. [*M. divaricata* (Braun), n. comb.];

Oncoxystus n. gen. [*O. longissimus* n. sp.]; *Commodes* n. gen. [*C. radulatus* n. sp.]; and *Serangites* n. gen. [*S. powelli* n. sp.]. Of the 31 valid, previously described North American species, 19 are assigned to genera treated herein. The remaining 12 species belong to yet undescribed genera but are provisionally left in *Scythris*.

Monophyly of the family Scythrididae is supported by seven apomorphies. The distribution of states of 40 adult structural characters is analyzed for evidence of relationships among genera and species lineages. Two major clades are hypothesized: the *Scythris* complex, with five genera and the nine informal species lineages, and the *Arotrura* complex, with nine genera. Inter-generic relationships of members of each complex are further analyzed and illustrated by cladograms.

ACKNOWLEDGEMENTS

Foremost, I take pleasure in thanking my supervisor, Dr. G.E. Ball, who provided outstanding guidance, encouragement and financial assistance, and who is instrumental in maintening in the Department a unique environment for research in systematics that is unsurpassed elsewhere, and who, by teaching and example, instills students to strive for scientific excellence.

I am especially indebted to J.A. Powell and R.W. Hodges for generous and invaluable help, discussions, and the sharing of field experience, and without whom the making of this thesis would have never been possible. P. Passerin d'Entrèves (Italy) and B.Å. Bengtsson (Sweden) provided stimulating correspondance and generously shared valuable knowledge about Palearctic scythridids.

I am grateful to all curators and individuals, listed in the Material and Methods chapter, who loaned specimens or made collections available to me during this study. I am indebted to the following fellow lepidopterists for answering enquiries and for discussions about Microlepidoptera: D. Adamski, V.O. Becker, A. Blanchard (deceased), R.L. Brown, I.F.B. Common, P.T. Dang, D.R. Davis, J.A. DeBenedictis, J.S. Dugdale, J.G. Franclemont, N.P. Kristensen, J. Kyrki (deceased), J.D. Lafontaine, E.G. Munroe, E.S. Nielsen, S. Passoa, K. Sattler, D.L. Wagner, and B. Wright. For hospitality during visits, I am grateful to J.A. DeBenedictis (Berkeley), and R.W. and E.R.S. Hodges (Washington, D.C.).

I thank members of my advisory committee, G.E. Ball, B.S. Heming, J.F. Addicott, M.V.H. Wilson, and the external examiner, D.R. Davis, for their critical review of this thesis.

My ideas about systematics were influenced over the years by discussions with G.E. Ball, fellow graduate students R.S. Anderson, J.M. Cumming, D.C. Currie, G.A.P. Gibson, D.R. Maddison, J.H. O'Hara and F.A.H. Sperling, and by fellow systematists at the

Biosystematic Research Center, A. Borkent, Y. Bousquet, H. Goulet, J.D. Lafontaine and D.M. Wood.

G. Braybrook provided technical assistance with the scanning electron microscope, D.A. Craig with computer facilities, J. Lacoursière (Dept. of Entomology, Univ. of Alberta) and W. Lukey (Biographics Unit, Agriculture Canada) with photography, M. Hunter and the Biographics Unit of the Research Branch, Agriculture Canada, with plate preparation, D.H. Kritsch with wing drawings and various other technical assistance, and B. Flahey with artistic advice.

Finally, I express my sincere appreciation to my wife, Marie, who endured the protraction of this study and frustations of being the wife of an entomologist and student.

Financial support for this study was provided by Natural Sciences and Engineering Council of Canada Grant A-1399, held by G.E. Ball, and by the Biosystematics Research Center, Research Branch, Agriculture Canada.

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1. INTRODUCTION

My first encounter with live scythridid moths was not exciting. In June 1983 near Edmonton, while sweeping weeds to collect attractive metallic green and red adults of the case-bearer *Coleophora trifolii* (Curtis), I found two small, ragged, brownish moths in my net; they were specimens of *Scythris impositella* (Zeller). Disappointment, or indifference, is indeed the impression felt, as I did then, by most collectors who have found Scythrididae.

But deceptive appearance should not deter, for it often hides marvels of another kind. Late on a sunny, scorchingly hot afternoon of early July 1984, I hopped onto an open dune near the Great Sand Hills of Saskatchewan. I was filled with expectation. Slowly, I began to pace the hot sand, net in hand, searching. Tiger beetles ran away and solitary bees foraged about. The relentless wind sweeping the dunes was blowing a film of sand and small debris over the bare dune surface. Then, some of the moving pieces of dirt struck my attention: while being blown off the surface, they seemed to flutter and, upon landing farther away on the surface, kept rolling as if animated by a movement of their own. At that moment my excitment grew, and I knew my expectations were right. I threw my net over one of the moving pieces of debris and caught a silverfish-sized, beige moth bouncing about swiftly inside the net bag. I immediately recognized it as belonging to a new species of scythridid moth of the genus *Areniscythris*, a most remarkable group of Scythrididae adapted to life on the shifting sand of active dunes. Discovery of several large populations of this new species over the Great Sand Hills and adjacent dunes further enhanced the pleasure of this collecting trip, undertaken specifically in the hope of finding such scythridids.

If not all scythridids have such unusual life history adaptations as do members of *Areniscythris*, all share fascinating attributes of another kind: under a non-descript, dull-colored appearance, scythridid moth display an extravagance in structural divergence and bizarre modifications of genitalia that is probably unsurpassed in other groups of Lepidoptera. Yet, despite such extraordinary qualities, taxonomists have paid little attention to the family.

Scythrididae are small, relatively stout, teardrop-shaped moths classified in the Gelechioidea (Lepidoptera, Ditrysia), a component of the informal taxon "Microlepidoptera". They occur in all biogeographic regions of the world except Antarctica and comprise both diurnal and nocturnal species. A single fossil questionably assignable to scythridids is known (Rebel 1935, Skalski 1976); thus, systematic hypotheses are based only on neontological data.

Classification of Scythrididae is in a preliminary state of knowledge (Powell 1976). More than 370 species have been described worldwide, but two thirds of those are from the Palearctic region, particularly western Europe (Bengtsson 1984), reflecting greater collecting effort and attention from taxonomists in the latter region. The number of described species worldwide probably represents only a small fraction of existing diversity, that being true not only for tropical regions but also for such generally well-studied regions as North America. In western Europe, fewer species probably remain to be described than are described. But on other continents, the situation is the reverse with undescribed species probably outnumbering those described by more than one order of magnitude. In the most recent checklist of Nearctic Lepidoptera (Hodges *et al.* 1983), 35 species are listed, but actual number was projected to be at least 10 times that (Hodges *et al.* 1983: xvi). The present study revealed that last figure to be already attained in collections, suggesting an actual number possibly being between 400 and 500 species. On this continent, the family is one of the least studied and most inadequately known groups of Lepidoptera.

I recognize three major problems in taxonomic treatment of Scythrididae: (1) lack of revisionary work at any taxonomic level and difficulty in identification and recognition of described nominal species on the basis of existing descriptions, (2) inadequacy of existing classifications and improper grouping of species into genera, and (3) lack of clear definition of the family.

The only comprehensive revision of Scythrididae is Zeller's (1855) treatment of the "world" fauna, which included only 48 nominal species known at the time, all but three from western Europe. Taxonomic knowledge added since Zeller's work has been mostly in the form of isolated species descriptions. General taxonomic works that deal with the Scythrididae are checklists, catalogues or faunal works (*e.g.* Zeller 1873, Heinemann and Wocke 1877, Smith 1891, 1903, Rebel 1901, Dyar 1902, Spuler 1910, Barnes and McDunnough 1917, Meyrick 1928, Lhomme 1935, McDunnough 1939, Leraut 1980, Falkovitsh 1981, Hodges *et al.* 1983, Bengtsson 1984), and none of these included any study of the group, mostly consisting of compilations of piecemeal information scattered in publications or repetition of previously compiled data. Besides isolated species descriptions, much of taxonomic treatment of scythridids is anecdotal and brief (*e.g.* Walsingham and Durrant 1909, Busck 1909, Joannis 1920, Le Marchand 1938, Sattler 1971, MacKay 1972, Zimmerman 1978).

Description and identification of scythridid species has been based traditionally on superficial features, principally color, size and shape. However scythridids are remarkably uniform in size and shape while being intraspecifically quite varied in features such as color. Thus use of external features *alone* is frequently unreliable for species recognition. Advent of study of genitalia revealed an extraordinary diversity of such structures in scythridids. But even though relatively early works showed the remarkable structures of scythridid genitalia and their taxonomic importance for species recognition (Hofmann 1888, Zander 1905), failure to study such structures and to refer to types did not resolve numerous identification problems until recently (Bengtsson 1984). Verifying species identity and solving synonymies by studying genitalia of type material (Passerin d'Entrèves 1974, 1976,1977, 1979, 1980) is a primary task with respect to the western Palearctic fauna where the majority of described species occur. With respect to the Nearctic fauna, the only study of types of some species is included in Clarke's illustrated catalogue of Meyrick's types housed in the British Museum (Clarke 1965, for the part on Scythrididae). Because Clarke dissected and illustrated genitalia, Meyrick's names of North American species can be interpreted with some confidence from publications alone, but they comprise merely six out of 42 names reported from the continent (Hodges *et al.* 1983).

Compounding identification difficulty is a lack of keys and illustrations. For example, Zeller's (1855) work does not include a key to aid in identification. Only two recent faunal works (Falkovitsh 1981, Bengtsson 1984) have provided modern keys using genitalia characters and adequate illustrations to identify species occurring in certain parts of western Europe. Forbes (1923) provided the only key to North American scythridids, and this volume included information about adults of only six species then known to occur in northeastern United States. Only three of the 42 descriptions of Nearctic nominal species have been illustrated.

The second and most serious problem in scythridid systematics is virtual lack of classification at every level other than sequencing of species, and lack of clearly diagnosed genera. Classification of scythridid species has traditionally been based on external features, stemming from the original arrangement of Zeller (1855) for European species. Lack of knowledge about structure of genitalia of most nominal species and lack of revisionary work has resulted in continued use of classification based on superficial features, up to present day . Color patterns, used by various authors to group and sequence species, show remarkable convergence among species otherwise dissimilar in genitalic characters. Recently Bengtsson (1984) introduced a new arrangement of Scandinavian species based on aspect of male genitalia; and Passerin d'Entrèves (1985 and in press) proposed a new classification of the species of *Enolmis* Duponchel based on a cladistic analysis of genitalic characters.

Earliest arrangements of Nearctic species were alphabetical (Smith 1891, Dyar 1902, Smith 1903). Subsequently, Barnes and McDunnough (1917) and McDunnough (1939) presented a different classification, based on unstated criteria which presumably were similar to Zeller's. Hodges *et al.* (1983) reverted to alphabetical listing to re-emphasize lack of knowledge about the group.

The great uniformity in external features led to the inclusion of most species in the single genus *Scythris* . Thirty other genera, most of them monobasic, have also been described or subsequently included by various authors in the Scythrididae (Powell 1976). Most have been differentiated from *Scythris* by characters of wing venation. All but four of them have been proposed for species mostly occurring in western Europe and the Mediterranean region. After they were proposed, inclusion of these genera in the family or recognition of their validity appears to have been followed by few subsequent authors and at least 13 of those genera are misplaced in the Scythrididae (Passerin d'Entrèves, pers. comm. 1984). No publication known to me lists, catalogues, classifies or even discusses all these generic names under the family Scythrididae, and references to them are scattered. In North America, three generic names have been proposed, *Arotrura* Walsingham, *Colinita* Busck and *Areniscythris* Powell; the first two were synonymized with *Scythris* by their own authors because features of wing venation originally used to define them were later found not to be unique. In genitalic features however, these genera are distinct from *Scythris* (Powell 1976).

The genus *Scythris* includes nearly all described scythridid species of the world and, as presently construed, is virtually equivalent to the name Scythrididae. But it has been recognized for some time that this "genus" is extremely heterogeneous in genitalic characters (Sattler 1971), hence possibly polyphyletic, and it needs to be re-organized into monophyletic groups.

Recently, several European species have been re-grouped informally on the basis of genitalic structures (Jäckh 1977a, 1978a, 1978b, Bengtsson 1984, Passerin d'Entrèves 1983, 1985, in press). Proposed assemblages are more natural than those based on external features, but Jäckh's and Bengtsson's arrangements are based on phenetic principles instead of ones. These two authors have also advocated use of informal species groups, instead of formally recognizing new genera, until the family is better understood. This approach followed that used in other groups of Lepidoptera (Johansson 1971 for Nepticulidae, Sattler and Tremewan 1978 for Coleophoridae). Families like the Nepticulidae and Coleophoridae however are not comparable to Scythrididae because they are structurally far more uniform than are scythridids. The species-group approach, while convenient as a temporary arrangement to study described western Palearctic species of scythridids, is impractical in regions such as North America where the fauna consists mostly of undescribed species.

In the Nearctic region, Powell (1976) noted that "an extensive array of morphological diversity is represented [...], far beyond that shown in Old World genera", yet the recent checklist (Hodges *et al.* 1983) includes only two genera (one is monobasic), and lists two other generic names as synonyms of *Scythris*. Powell's (1976) discussion implies that few, if any, Nearctic species seemed closely related to *Scythris* "in the strict sense.", *i.e.* possess genitalia phenetically similar to those of the type species of *Scythris*. The present study indicates actual number of Nearctic genera to be between 40 and 60. Few of these appear closely related to Palearctic genera.

Meaningful progress in scythridid systematics will result initially from clearly defining genera using principles of phylogenetic systematics, that is, defining and naming monophyletic groups (genera) based on possession of shared derived characters. Function of the genus category in classification is precisely to indicate divergent lineages of groups of species. The great amount of structural divergence in scythridids renders relatively irrelevant worries about excessive splitting of a "genus" like *Scythris*, a concept that only perpetuates ignorance. To wait until phylogeny of the family is better understood before beginning to recognize formal groups will only slow progress in that direction.

Intertwined with lack of clear definition of the genus *Scythris* and of other genera included in the Scythrididae is inadequate definition of the family and this constitutes the third major problem in taxonomic treatment of this group. Scythridid moths are mostly recognized phenetically by general habitus and by a combination of external features such as head shape, proportions of articles of labial palpi, wing shape and venation, none of which is unique to the group. Great weight is given to wing venation features (Common 1970, Bengtsson 1984), some of which are markedly homoplastic in Microlepidoptera. The systematic position of *Scythris* (= Scythrididae) long meandered across various groups of Microlepidoptera (Zimmerman 1978: 211). Suggestion that scythridids belong to the Gelechioidea was made long ago by Mosher (1916), based on pupal features, but accepted only recently (Common 1970), based on the adult features of a scaled haustellum, upcurved labial palpi, maxillary palpi folded over the base of haustellum and lack of chaetosemata [sensory organs present on the head of many Lepidoptera]. However, monophyly of the family based on unique derived characters shared by all member taxa is still not documented, a situation common to most families of Gelechioidea, and relationships to other families of Gelechioidea are unresolved (Bengtsson 1984). Classification of that superfamily is in a state of confusion (Zimmerman 1978: 209, Hodges 1978: 6). Difficulty in phylogenetically defining the Scythrididae (and other family groups of gelechioids) results from failure to differentiate and evaluate levels of apomorphy of character states and, to a lesser degree, from not studying more structural characters in addition to external features traditionally used.

The general intent of this thesis is to investigate the classification of Nearctic Scythrididae, particularly at the species and generic levels, based on study of adults (lack of available material prevented study of immature stages). A secondary goal is to provide ground work for tentative phylogenetic definition of the family and classification of included taxa.

In chapter 3, classification of all nominal species included in, or mentioned as possibly belonging to the family is reviewed. Synonymies are revised, recognized species are re-described and illustrated, with emphasis on genitalic characters, and keys are provided to aid in identification. In chapter 4, a description of the family is provided and a selection of Nearctic genera are revised. Genera described and discussed encompass about a third of described and undescribed Nearctic species in collections. The aim is to provide a basic systematic structure to a family largely devoid of such organization. In chapter 5, evidence to support monophyly of the family is assessed and relationships of genera and described species are evaluated in a cladistic analysis which serves as the basis for the classifications introduced in chapters 3 and 4.

2. MATERIAL AND METHODS

2.1 Material

Approximately 8000 adult specimens of Scythrididae were examined during the course of this study. Most of this material was borrowed from various institutions and from a few individuals, which are noted below. Acronyms written in full capitals indicate institutions, whereas acronyms beginning with two capitals and ending in lower case letters indicate private individual collections. Full addresses, as well as names of curators or collection managers of institutions, are provided. A "t" in brackets following the acronym of an institution indicates a collection with scythridid type material, and an asterisk (*) indicates a major holding of North American scythridids, both in number of specimens and diversity. This material was supplemented by specimens collected by me, which are deposited in CNC. All primary types of Nearctic scythridids that could be located were examined except those housed in the British Museum (Natural History), London, which were unavailable. Specimens representing species belonging to other families of Lepidoptera and which were examined for character analysis and outgroup comparisons were from the CNC and the USNM.

AMNH	Department of Entomology, American Museum of Natural History, Central Park West at 79th Street, New York, New York 10024, U.S.A. (Dr. Frederick H. Rindge).
ANIC	Australian National Insect Collection, Division of Entomology, CSIRO, P.O. Box 1700, Canberra City, A.C.T. 2601, Australia (Dr. Ebbe Schmidt Nielsen).

ANSP (t *)	Department of Entomology, Academy of Natural Sciences of Philadelphia, 19th & Parkway, Logan Square, Philadelphia, Pennsylvania 19103, U.S.A. (Mr. Donald Azuma).
BABen	Mr. Bengt Å. Bengtsson, Box 71, S-380 74 Löttorp, Sweden.
CAS (t *)	Department of Entomology, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118, U.S.A. (Dr. Paul H. Arnaud).
CMP	Section of Entomology, Carnegie Museum of Natural History, 4440 Forbes Avenue, Pittsburgh, Pennsylvania 15213, U.S.A. (Mr. Robert L. Davidson).
CNC (t)	Canadian National Collection, Agriculture Canada, Biosystematics Research Institute, K.W. Neatby Bldg., C.E.F., Ottawa, Ontario K1A 0C6, Canada (Dr. J. Donald Lafontaine).
CU	Department of Entomology, Cornell University, Ithaca, New York 14853, U.S.A. (Dr. James K. Liebherr).
FMNH	Division of Insects, Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, Illinois 60605, U.S.A. (Dr. James S. Ashe).
INHS	Illinois Natural History Survey, Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820, U.S.A. (Dr. George L. Godfrey).
JBHepp	Dr. John B. Heppner, Center for Arthropod Systematics, Bureau of Entomology, DPI FDACS, P.O. Box 1269, Gainesville, Florida 32602, U.S.A.
LACM	Natural History Museum of Los Angeles County, 900 Exposition Boulevard, Los Angeles, California 90007, U.S.A. (Dr. Julian P. Donahue).

LEM	Lyman Entomological Museum, Macdonald College, 21111 Lakeshore Road, Ste.Anne de Bellevue, Québec H9X 1C0, Canada (Dr. P. Michael Sanborne).
MCZ (t)	Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts 02138, U.S.A. (Dr. Scott R. Shaw).
MSU	Mississippi Entomological Museum, P.O. Drawer EM, Mississippi State University, Starkville, Mississippi 39762, U.S.A. (Dr. Richard L. Brown).
NSM	Nova Scotia Museum, 1747 Summer Street, Halifax, Nova Scotia B3H 3A6, Canada (Dr. Barry Wright).
OSU	Department of Entomology, Oregon State University, Corvallis, Oregon 97331, U.S.A. (Dr. J.D. Lattin and Mr. John D. Oswald).
SMEK (t)	Department of Entomology, Snow Entomological Museum, University of Kansas, Lawrence, Kansas 66045, U.S.A. (Dr. George W. Byers and Mr. Robert W. Brooks).
UAE	Department of Entomology, University of Alberta, Edmonton, Alberta T6G 2E3, Canada (Dr. George E. Ball and Mr. D. Shpeley) (Lepidoptera material is in the K. Bowman collection).
UCB (t *)	Essig Museum, Division of Entomology and Parasitology, 201 Wellman Hall, University of California, Berkeley, California 94720, U.S.A. (Dr. Jerry A. Powell).
ULK	Department of Biology, University of Louisville, Louisville, Kentucky 40292, U.S.A. (Dr. Charles V. Covell).

USNM (t *)	Department of Entomology, U. S. National Museum, Smithsonian Institution, Washington, D.C. 20560, U.S.A. (Dr. Ronald W. Hodges).
ZMUC (t)	Zoologisk Museum, Universitetsparken 15, DK 2100 København, Denmark (Mr. Ole Karsholt).

2.2 Collecting and preparation of specimens

2.2.1 Collecting and mounting of adults

Collecting. — Adult scythridid moths are either diurnal or nocturnal, depending on the species. In the Nearctic region, about one third to one half of the species are nocturnal, in contrast to western Europe where the great majority of species are diurnal. Diurnal species are distributed in all parts of North America, but predominate over nocturnal species in northern and montane regions. Nocturnal species appear to be more abundant in xeric habitats, particularly in arid parts of the southwestern United States.

Diurnal scythridids are active at mid-day, especially in sunny weather, and frequently go to flowers (Powell, 1975). Visiting flowers is a good means of finding them. However, many individuals may be perched on the vegetation around flowers and because of their small size, they are often very difficult or impossible to see, and are likely to elude a mere visual search. To find and capture them, it is best to gently sweep the vegetation with a fine-meshed net. My experience shows that even sweeping in vegetation where no scythridids have been visually detected may yield unexpected numbers of specimens. In one particular instance, a careful, hour-long search in a weedy field near Edmonton, Alberta one afternoon produced only four scythridids of one species, whereas a series of sweeps conducted immediately after in the same place and lasting less than half an hour yielded more than 40 specimens belonging to three species. Failure to find numerous scythridids by mere visual search is probably due to the fact that the moths are very skittish and swift, and quickly drop among the vegetation or fly off if disturbed. However, once caught in a net, they frequently tend to feign death for a brief time. If weather conditions are very hot, however (as in deserts), some scythridids try to escape the net immediately and very swiftly.

Nocturnal scythridids are best collected at light. If one tends a sheet to collect, my experience shows that specimens of some species are very skittish, resting on the sheet for only very brief periods and being easily disturbed. For several species, series in collections commonly consist mostly of individuals of only one sex, usually males. This suggests that females of these species may not be as readily attracted to light as males are, or that they are so but come to rest in the nearby vegetation and thus escape collection. It is also possible, though I think less probable, that individuals of that sex are rare.

Moths in the net or on a sheet are caught by placing an inverted vial over them. Specimens are kept alive in separate glass vials or tubes with straight-sided rubber stoppers that fit the neck of the tubes very snugly. Tight fitting of the stoppers is critical because moths frequently try to enter narrow spaces, such as the interstice between the neck of a tube and a wedge-shaped cork; moths wedged in this manner are invariably rubbed or damaged, and can be crushed when the cork is removed. Collected specimens are kept alive in a dark (and cool, if at all possible; if not, at least in the shade) place until ready to be killed and pinned.

Killing and mounting. — The technique used for killing, pinning and spreading generally follows that presented by Zimmermann (1978: 50-58), with a few modifications. I outline the major steps here.

Scythridids are best killed with ammonia or ethyl acetate. Cyanide is not recommended because many scythridids can amazingly withstand the poison for *several* hours before they are slowed down and finally killed. During that time, they run actively in the vials or killing tubes and badly rub their scales and cilia. Upon death, they become very rigid and require relaxation for spreading. Ammonia (a solution of about 30% ammonium hydroxide) kills moths in a relaxed state and, if used in moderate amount, does not moisten specimens even after several hours. Ethyl acetate kills scythridids quickly but tends to stiffen the moths after they have been exposed to the vapors for more than a few minutes. If left in for several hours, they eventually relax, but then absorb a lot of ethyl acetate and become moist and sticky. I prefer ammonia, for specimens killed by its fumes can be spread immediately with great ease. Specimens are anesthetized in glass tubes closed by a cork stopper into which a polyethylene microvial filled with ammonia-soaked (or ethyl acetate-soaked) absorbent cotton has been inserted. Only a few seconds are necessary for anesthesia to occur, but specimens are left in killing tubes for about 15 minutes to ensure that they are dead. They should not be left in the killing jars for too long, however, because they begin to dry.

Relaxation is not necessary with ammonia-killed moths. Sometimes however, if some rigidity has been acquired (moths left in tubes for several hours may have begun to dry), it is necessary to relax the moths. Specimens are removed from killing tubes shortly after death and pinned immediately. Pinned specimens are then placed on a polyethylene pad placed in a moist chamber (a deep Petri dish layered with water-soaked absorbent paper). If relaxed, specimens are spread immediately; if somewhat stiff, specimens are left to relax for a few hours (4-6 hours is usually sufficient) in the moist chamber; specimens must not be left in the moist chamber too long otherwise they absorb excessive moisture, become sticky and matted and spread with great difficulty, resulting in shabby specimens. Smaller moths absorb moisture much faster than larger individuals.

If a large series of a species was collected, it is highly desirable to preserve at least some specimens in 70% ethanol, or in Bouin's fluid, for eventual study of exoskeletal structures and internal tissues. This mode of preservation eliminates the need to relax and unpin specimens needed for such studies, and procures specimens without a pin hole through the thorax (pinning, especially with regular-size insect pins, may damage important parts of the thoracic exoskeleton).

Specimens that are rubbed or lack parts of appendages are suitable for such preservation in fluid, which is better than discarding them.

All scythridids are best pinned with minuten pins and double-mounted on polyporous strips. High-quality stainless steel minutens should be used. I found cheaper, black-coated minutens to frequently bend at their point, and this results in damage to specimens when double-mounting is done because it causes such minutens to "spring" during insertion. In addition, it is preferable to shorten minutens by cutting them with scissors to an appropriate length; most minutens are unnecessarily long for Microlepidoptera, and this also increases risk of damage during handling of dry, spread specimens, again because they tend to be springy.

In order to pin specimens squarely through the mesoscutum, the procedure is carried out under a stand-held magnifying lens or a low-power dissecting scope (a magnification of 5x is fine). Specimens are poured from a killing jar onto a piece of soft white cotton cloth which is placed under the scope or lens. The cloth should be folded several times to provide thickness as a pinning medium. For more accurate pinning, minutens are handled with curved forceps. To prevent a specimen from rolling sideways while the minuten is inserted into the mesoscutum, and thus pinned at a slant, a regular insect pin bent in the middle at an angle is used to press delicately on the back of the moth. The minuten is thus inserted through the body until it pierces through the ventral side; the cloth is lifted a little and the minuten inserted all the way, leaving a short length above the thorax sufficient for safe handling with forceps. Use of cotton cloth as a pinning surface is highly recommended because the claws of moths grip its surface and prevent slippage.

Spreading is done according to the technique described by Hodges (in Zimmermann, 1978: 63). Spreading needles are made with stainless steel minutens (size 0.15) glued to thinned and shortened toothpicks.

2.2.2 Genitalia preparation

Various methods are used for the preparation of genitalia of Microlepidoptera (*e.g.* Clarke 1941, Robinson 1976, Zimmermann 1978: 87, Pitkin 1986) but all are really variations on the same general procedure modified to suit the requirements presented by different groups of these moths. The major steps involved are as follow: (1) remove the entire abdomen and relax in a potassium hydroxide (KOH) solution; (2) separate the genitalia from the rest of the abdomen and thoroughly clean both parts of scales and macerated soft tissues; (3) stain lightly to bring out some parts, especially membranes or lightly sclerotized structures; (4) dehydrate and mount both the genitalia and abdominal skin on a microscope slide in a permanent resin, either Canada balsam or Euparal.

Because of the special configuration of scythridid male genitalia, I had to adapt existing methods to some degree to enhance study of these organs. Some adaptations were also necessary for the procedure involving female genitalia, because of the taxonomic importance of preserving the shape of very delicate membranous structures. Most of the adaptations represent only minor changes from the methods presented in the works cited above. Nevertheless, I think that it is important to describe my technique in detail because with such delicate technical work, success often depends on apparently insignificant details. Because of differences in treatment of male and female parts, I describe their preparation separately.

Male genitalia. — The complete abdomen is removed from the pinned specimen by gentle upward pressure. This is done using a dissecting stereoscope by introducing the tip of fine forceps, held closed, ventrally between the metacoxae and the abdominal base, then by gently and slightly releasing the forceps tip. A slow and repeated release of the forceps is done, rather than a sudden snap which could break or puncture the brittle cuticle. Opposite pressure being applied from beneath simultaneously to the coxae and the abdominal base prevents severance of the metathorax and hindwings. I found this to work better than the usually advocated downward pressure on the dorsum of the thorax while applying upward counter-pressure on the abdomen (Clarke 1941, Robinson 1976), especially for specimens whose thorax is loose (accidental severance of the metathorax frequently occurs when specimens have been pinned with pins too large relative to their body size, because such pins tend to dislocate the thorax). A piece of cloth is placed under the specimen to prevent the falling abdomen from bouncing off and possible loss.

The severed abdomen is picked with a fine brush wetted in 70% ethanol and placed in a small dish or tube containing 10% potassium hydroxide (KOH) in a 15% ethanol solution. Use of a weak ethanol solution instead of plain water is preferred because it has a lower surface tension and thus soaks the abdomen better. The abdomen is left to relax and macerate in the KOH solution at room temperature for 12-15 hours. Use of a cool solution is more gentle and yields more uniform results than the frequently used method of heating the potash solution for a few minutes. After KOH treatment, the abdomen is transferred to two washes of 15% ethanol, then placed in a dissecting dish in 30% ethanol.

Dissection of genitalia and cleaning of abdomen are carried out using two very fine forceps, a blunt needle with the tip shortly bent at an obtuse angle, a fine, hooked needle and a small snipe feather used as a brush. Needles and feather are mounted on wooden handles to facilitate holding and handling. A small feather, such as that found at the extreme base of the anterior edge of a snipe wing, is far superior to a fine brush for cleaning because it is relatively stiffer, does not spread when immersed in a liquid, and has a much narrower and compact tip than any fine brush.

Scales are brushed off with the feather while holding the abdomen down against the bottom of the dish with the blunt needle, first cleaning especially around the genitalia to expose them. If the genitalia are withdrawn, they are extruded by pushing caudad with the feather. The genitalia are separated by teasing attaching membranes with fine forceps, pulling short stretches at a time to avoid tearing across weak abdominal sclerites. Modified eighth terga and/or sterna are left attached to the abdomen. If they are partly fused to the genitalia, the latter are carefully separated along fusion lines; if this is not done, study of the genitalia can be rendered unintelligible because too many structures overlap one another (Passerin d'Entrèves 1976). Genitalia are cleaned of deciduous scales, and extraneous membrane left attached to the tegumen and vinculum. Debris in interstices is removed with a hooked needle or feather. Care is taken not to remove inner glanduliform structures that are found inside the tegumen of some scythridids. The anal tube is trimmed, except for a short length which is left attached; position of the anal tube and anus is frequently a critical reference point for recognition of structures in the complex and highly derived genitalia of male scythridids; consequently, a portion of it should always be left. The abdomen is then thoroughly descaled with the feather and the inside cleaned of all debris, macerated tissues and tracheae with a hooked needle. Alcohol is changed a few times during the cleaning process. Membranes and debris from macerated organs are more easily seen and removed against the dark background provided by a black stage.

Both abdomen and genitalia are then lightly stained with two stains: first with mercurochrome diluted in 30% ethanol, second with chlorazol black dissolved in 70% ethanol, each followed by a brief wash in clean ethanol solution to remove excess stain. Double staining was found useful because each stain brings out different parts of the genitalia and abdomen, thus resulting in better contrasts: mercurochrome stains lightly sclerotized structures better whereas chlorazol black preferentially stains membranes. If temporary storage in glycerine is used (see below), it is preferable to defer staining until after the glycerine has been washed off, when ready to make a permanent mount, because the water removes much of the stain.

At this point, abdomen and genitalia can be either temporarily transferred to glycerine or mounted permanently on a microscope slide. I have found temporary mounting in glycerine to be a necessity if one is to understand the unusually complex and aberrant structure of scythridid male genitalia. Temporary placement of such genitalia in glycerine is thus appropriate for easy rotation, positioning, and examination at various angles while obviating the need to make several permanent slides of different orientations prior to understanding taxonomically important structures. The ringed slides described below are examined with either a stereoscope or a light-transmission microscope (at magnifications up to 400x depending on the focal distance of the microscope). For this procedure, genitalia are first transferred into a small dish of glycerine which is gently heated (under a desk lamp) to speed up evaporation of alcohol from the glycerine. They are then transferred into glycerine-filled rings glued onto microscope slides and examined without cover slips: this allows the genitalia to be freely moved with a needle. For drawing with a drawing tube, the genitalia are immobilized by wedging them between small glass chips. Rings are made of sections of Plexiglass® tubes cut at appropriate thickness. I use two ring diameters: 12 mm (1/2 inch) cut into 2 mm thick rings for smaller specimens, and 25 mm (1 inch) cut into 3 mm thick rings for larger specimens. Rings are glued to glass slides with Euparal. Such glycerine-stored specimens can be permanently mounted later. For mounting, dissections are soaked in distilled water for at least 24 hours, transferred to several washes of distilled water until all glycerine is removed and stained as described above. Following staining, the procedure for permanent slide mounting is the same as described below for other genitalia.

For permanent mounting on slides, structures are transferred, after staining and washing, to 70% propanol (isopropyl alcohol), then to absolute propanol for dehydration and hardening. Separation of some parts or removal of the aedeagus, if warranted, is done while the genitalia are still immersed in 70% propanol. Immediately upon transfer into absolute propanol (before hardening takes place, which takes only a few minutes), parts of the genitalia may be spread or arranged, if possible, so as to give maximal exposure of taxonomically important structures (see below). Dissected parts can be left in absolute propanol indefinitely, but are ready to be mounted within a few minutes. If Canada balsam is used to make slide mounts, the additional steps of transferring into cedarwood oil (for clearing) is desirable before embedding in balsam. If Euparal is used, parts can be transferred from propanol directly into Euparal. A small blob of medium (just enough to cover the parts) is first applied to the slide, in which the parts are then placed using fine hooked needles; this procedure is carried using a dissecting stereoscope to ensure parts are not lost and are correctly positioned on slide. Appropriate positioning of parts requires frequent checks and rectifications during the first few minutes following embedding, because parts will drift or rotate somewhat before the medium sets (I prefer to use a fluid, rather than a viscous, medium). Slides are left to set for at least 12 hours at room temperature in a covered, dust-free place, before more mounting medium is added and the cover slip applied. Small vinyl props are placed at the edge of the cover slip to prevent compression and displacement of the genitalia upon hardening.

The standard procedure of spreading open the valvae and mounting the male genitalia ventral side up cannot be applied successfully to scythridids; attempting to do so either results in distortion and renders interpretation of genitalia structures very difficult or misleading. Recently, a method that consists in "unrolling" the genitalia, that is in separating the tegumen-vinculum articulation on one side and laterally unfolding the two halves around the other articulation, has been described for preparing the genitalia of Microlepidoptera that cannot be spread in the standard manner (Pitkin 1986). Sattler (1981) used this method successfully with *Scythris inspersella* (Hübner). This solution however is not applicable to many scythridid genitalia in which fusion of parts is more extensive, or the diaphragma variously sclerotized and folded, or the tegumen so markedly convex that unrolling results in awkward positioning. Depending upon configuration, I mounted genitalia in either of two ways: (1) genitalia left entire and mounted laterally with, if possible, the valva on the upper side of the mount removed and mounted flat on the side (outer side of valva up) (Passerind'Entrèves 1976); (2) genitalia with the dorsal portion (tegumen-uncus-gnathos complex) separated from the ventral portion (vinculum-valvae-aedeagus complex), with the former mounted laterally and the latter mounted flat with the dorsal side up. Reduced or strongly fused valvae are not detached, as attempts to remove them may cause tearing or damage. Very small or markedly fused genitalia are left whole and oriented on a slide to provide optimal view of important features (a lateral oblique orientation is usually the most suitable). It is not recommended to separate the aedeagus from the rest of the genitalia, as is usually done in other groups of Lepidoptera. Again, in scythridids, this structure is frequently fused or strongly ankylosed by the juxta and its removal may cause damage to it or other surrounding structures. In many scythridids, the aedeagus is very small and, if separated, can be easily lost or will be extremely difficult to position appropriately on slide. In addition, orientation of the ankylosed aedeagus in relation to other parts of the genitalia is frequently of taxonomic importance.

Female genitalia. — Dissection of scythridid female genitalia is more difficult and far more time-consuming than that of male genitalia because of the membranous nature of most structures and the desirability to preserve the corpus bursae as fully inflated as possible. Removal of the abdomen and maceration in potash is as described above for male genitalia. The abdomen is transferred from potash into a dissecting dish with 30% ethanol using a wide-mouth dropper; this is to ensure that the relaxed and inflated abdomen remains submerged to avoid collapsing. To dissect, the abdomen is carefully held at its anterior end with fine forceps and the posterior part around the genital segments partly descaled by careful feather strokes without applying any pressure that could compress the abdomen and thus collapse the bursa; just enough scales are removed along one side in the pleural region and on the segment preceding the ostium or sterigma to see underlying membranes and demarcation of sclerites. Using two forceps, the abdomen is then opened lengthwise by carefully teasing the pleural membrane on one side (left side) up to the segment anterior to the ostium (the 6th or 7th, depending upon the species); then the membrane of the segment anterior to the ostium or sterigma is cut around the abdominal wall to sever the abdomen from the genitalia and ovipositor-bearing segments. Great care is taken not to tear off the thin and very delicate ductus bursae, which is usually difficult to see amidst macerated tissues. Abdominal teasing and severance from the genitalia, as well as all subsequent steps in cleaning the genitalia, are carried out over a dark background (black microscope stage) with a bright illumination, so that translucent membranous parts stand out clearly (this also eliminates the need to stain at an early stage of the dissection in order to distinguish membranes). Severed genitalia are then carefully cleaned of extraneous macerated tissues and tracheae by exerting gentle pulls with one forceps while holding with another. The holding pinch of the forceps must be as light as possible, otherwise membranous parts adhere to the forceps and thus risk being torn. If a part sticks to the forceps, it must be delicately brushed off, and not pulled off, again to avoid tearing. The cleaning process must not be hastened if the bursa or ducts are to remain intact. Accessory glands and the hindgut are severed just above inception of the common oviduct, which is also trimmed, and discarded. The spermatheca is left if in good condition. After cleaning is completed, the ovipositor is carefully extended by pulling it with feather strokes. The rest of the abdominal cuticle is then thoroughly descaled and cleaned of debris.

Frequently at this stage the bursa is fairly swollen but not completely inflated. To inflate it further, the genitalia are transferred carefully with a wide-mouth dropper into a dish with water or 10% ethanol, where they are left for12-24 hours. If the genitalia float at the surface, they are sunk and held at the bottom by a small chip of glass or a minuten placed over the ovipositor (for some specimens, this is not possible as air bubbles are easily trapped on the cuticle due to the relatively high surface tension of the water). If the bursa is not completely inflated after the aforementioned period, it is usually an indication that it will not inflate further (this possibly indicates a virgin female whose bursa has not been inflated by sperm).

After inflation, the bursa and ducts are drawn under a stereomicroscope over a dark field (stage) with aid of a camera lucida; this is done into a dish of 30% ethanol, with the genitalia being held into position with glass chips. Drawing membranous parts at this stage ensures that a record of the inflated state of these structures is preserved. This is because it is extremely difficult to make a permanent slide mount in which the bursa, in particular, will remain fully inflated, and this in spite of great precautions that may be taken in the process of dehydrating and embedding. The method of inflating the bursa with propanol injected into the bursa with a fine seringe, used for larger Lepidoptera such as Noctuidae (Hardwick 1950), is not suitable for small moths with a minute ostium and extremely fine ductus bursae.

Scythridid bursae are so delicate that, often, it takes only a few ripples in the membrane to initiate collapse when the structures are transferred from 80 or 90% alcohol into absolute or near-absolute alcohol. When this happens, total collapse usually ensues when embedding into balsam or Euparal (with the latter medium, even using an intermediate step of transferring into Euparal essence causes collapse because the essence has a greater viscosity than absolute alcohol). However, I have obtained a few good mounts in which shape of the bursa is fairly well preserved by using the following procedure: (1) in 30% ethanol, puncture or tear a small hole in the bursa to facilitate exchanges of solutions; (2) stain with mercurochrome as described above; (3) transfer successively into dilutions of 40%, 50%, 60% and 70% ethanol, leaving the genitalia in each dilution for 15-30 minutes; (4) stain with chlorazol black in 70% ethanol as described above; (5) transfer successively into dilutions of 80%, 85%, 90% and 95% ethanol, leaving the genitalia in each dilution for 15-30 minutes; (6) transfer into absolute propanol; (7) transfer carefully to a dish with propanol layered over Euparal, into the propanol layer and wait until specimen has sunk into the Euparal layer; (8) carefully removed the propanol layer, remove specimen carefully and mount on slide. The abdominal skin is processed as that of the male: after staining, it is transferred into absolute propanol, flattened with a glass chip and left to dehydrate, then mounted on slide alongside the genitalia. Because the layer of mounting medium on slides of female genitalia is fairly thick due to the inflated bursa, I use concavity slides, such as those made for studying live microorganisms in a "hanging drop". Use of such slides obviates the need to add rings to prevent spillage of the medium, or cover props to prevent compression of the specimens.

At present, I have had little success in preserving inflated female genitalia of scythridids on permanent slides according to the method presented above (which is also very time consuming). I am unaware of any such method described in publications that has been successfully applied to Microlepidoptera. Obviously a new method will have to be devised and I am still experimenting. In some works, drawings of genitalia with inflated bursae are presented, but without explanation as to how such results were achieved. The habit among microlepidopterists is to simply flatten out the bursa to expose the signa, which are the structures of taxonomic importance. In Scythrididae, signa are absent, and as a consequence no author seems to have paid attention to the shape of membranous parts nor to the arrangements of the various ducts and glands. Yet these are quite varied and have good taxonomic value, as will be discussed in this work.

For all wing and genitalia preparations, each slide was given a number that was also indicated on a green label attached to the corresponding specimen.

2.2.3 Wing preparation

Venation and other structural details of wings of Microlepidoptera cannot be studied easily and with clarity because of the scale cover. It is thus necessary to prepare wings of selected specimens to study such structures. Two methods were used, to bring out different features or qualities of features of wings: (1) bleaching, staining and embedding in resin on slide; (2) partial descaling of dry wings on specimens. The bleach and stain method was used more commonly to make large series of wing preparations and scan for characters. The method of descaling is a slow and arduous process and great care must be exercised in order not to damage the wings, but it yields a better view of some structural details, especially of reduced or obsolete veins or of the concave/convex aspect of veins.

Slide-mounted wings. — The method used is essentially that described in Zimmermann (1978: 83-87), with the following minor modifications: after bleaching, wings were washed in 30% ethanol instead of water because of the lower surface tension of ethanol; after staining, wings were washed briefly in 70% propanol, then transferred into absolute propanol where they were pressed with small pieces of glass (made from broken slides) and left for a few minutes to dehydrate; after wings were placed on a slide, a thin layer of Euparal was applied over them in very small blobs using a blunt needle with a bent tip; slides were left in a dust-free place about 12 hours before more Euparal was added and the cover slip applied.

Descaled wings. — The moth was placed on a stand and the pair of wings to be descaled was supported from underneath as follow: a small piece of thick (0.18mm) plastic tracing film mounted on a pin was placed on the specimen stand and the moth's height adjusted so that the distal half or two-thirds of its wings rested flatly on the piece of plastic. Scales were then brushed off with a snipe feather. For wings treated by this method, only the area of the veins to be checked were usually descaled. I have usually found it sufficient to descale only one wing surface to see veins.

2.2.4 Whole body preparation

To study skeletal features, entire specimens must be cleaned of scales and internal tissues. Ethanol-preserved specimens are ideal for this purpose but very few scythridids preserved in that way were available. Hence, dry, pinned specimens had to used for most dissections. Shabby, ragged or unspread specimens were selected, ensuring that at least one leg of each pair and one antenna were complete and that the moths were pinned squarely, preferably with a minuten, so that the thorax would be minimally damaged by the pin.

The abdomen, all four wings, antennae and legs of a selected specimen were carefully removed, working under a stereoscope. If the wings and abdomen were not needed for further study, they were stored in a gelatin capsule placed on the original pin with the labels; if they were to be studied, they were prepared as described above in sections 2.2.2 and 2.2.3. Legs and antennae were detached by a gentle push at their base with a blunt needle or fine forceps; legs were broken between the trochanter and femur. A piece of cotton was placed under the specimen stand to catch falling parts. Removal of appendages prevented breakage at undesired points before they were sufficiently relaxed by the maceration process. Detached parts were picked with a fine brush wetted in 70% ethanol and placed in a tube containing a solution of 10% KOH. The rest of the body still on the pin was also dipped in 70% ethanol for wetting and placed in the tube of potash along with the other parts. For an alcohol-preserved specimen, only the wings and abdomen were removed before the entire specimen was transferred to the potash. The tube was then gently heated in hot water for 2-5 minutes to accelerate maceration, following which all parts were washed in distilled water and transferred to a dissecting dish in 30% ethanol. Parts were then carefully descaled as described in section 2.2.2. The descaling process is very time-consuming but must not be hastened because the lightly sclerotized skeleton of such fragile Microlepidoptera is easily damaged; the antennae are especially easy to dislocate and it is not practical to attempt to remove all of their scales. After descaling, the head and the three thoracic segments were dismembered to clean the inside of macerated tissues and to later facilitate their study; dismembering is especially important to examine the posterior part of the mesothorax and the anterior part of the metathorax, which are closely juxtaposed to one another, and to facilitate examination of the metathoracic furca. All parts were then lightly stained with mercurochrome as for genitalia and placed in glycerine on ringed slides.

2.2.5 Specimen examination

Dried adult specimens were examined with a Wild M5A or a Carl Zeiss stereoscopic microscope illuminated with incandescent light. Colors, hues and lustre are described as seen with a stereoscope. As was noted by Bengtsson (1984), scythridid specimens appear paler under a stereoscope than to the naked eye, probably because of the brighter illumination; they also appear to have a more pronounced metallic lustre or iridescence. While examining features other than colors, reflection of light from the specimen being examined was reduced by mounting a piece of Cronaflex® tracing film to the specimen holder, between the specimen and the light source.

Slide-mounted specimens or parts were examined with a Carl Zeiss stereoscopic microscope with a trans-illuminator mounted on the stage, and, for high magnifications and/or special illumination (phase-contrast or differential interference contrast), with a Nikon Optiphot compound microscope equipped with a system for Nomarski differential interference contrast, and a drawing tube.

Details of certain structures were examined with the aid of a Cambridge Stereoscan 250 scanning electron microscope (SEM). Specimens that needed to be dissected were prepared by first relaxing, cleaning and dehydrating them in ethanol as described above for genitalia, then critical-point dried, attached on SEM stubs using double-sided sticky tape and grounded with silver paint. Other specimens that did not need to be dissected, such as whole body parts with their scale vestiture, were mounted directly on SEM stubs. Specimens were then coated with gold during four minutes in a sputter coater.

2.3 Description format and treatment of taxa

Previously described species treated in the synopsis. — For previously described species, reference to the original publication of the valid name and of each junior synonym is provided. For each name entry, citations from major works, checklists or catalogues are provided. The synonymical list is presented chronologically. In species for which nomenclatural changes are proposed, the synonymical list is followed by notes about synonymy, where some historical aspects are discussed and reasons for present nomenclatural changes given. In the section "Type material examined", label data for primary types, or for paratypes or paralectotypes when primary types were not examined, are cited in full, following the system described by O'Hara (1982). Repositories for all types, whether examined or not, are given preceding the citation of label-data. Type localities are also repeated after the citation for type material, either to correct or to add precisions to type label data.

Diagnostic information, including comparison with similar taxa, is provided under the heading "Recognition". Comparison with undescribed species was included whenever the possibility of confusion with those was great. Determinations made with the keys should be verified by consulting this section under the pertinent taxa.

Descriptions are divided into seven subsections as follow: size, head, thorax, wings, abdomen, male genitalia, and female genitalia. Complete descriptions are provided for all previously described species of the synopsis recognized as valid, except for four nominal species whose identity remains undetermined and which are treated separately at the end of the synopsis as *nomina dubia* , and for *Scythris oxyplecta* for which no material was examined. Descriptions are presented in a uniform format with same style and heading. Because original descriptions of most Nearctic Scythrididae are either too brief or inadequate, most of them not providing information on structural characters of the genitalia, and because of the great number of undescribed species, descriptions presented here are detailed. Color attributes are fully described for each species; structural attributes are also fully described for each species unless they are shared with a closely related species. Due to the fact that previously described species of Nearctic Scythrididae represent a random and very restricted sample of existing diversity, including some related species as well as a mixture of distantly related or unrelated species, it was difficult to develop non-repetitive descriptions; hence non-varied structural attributes have been repeated in all descriptions except for closely related species.

Variation, when examined or pertinent, is included throughout each species description, but its most striking features are summarized in a separate section following the description. For color attributes, variation is discussed in terms of how it affects the appearance of specimens. Variation in structural features of genitalia was examined in a limited way in only a few instances when a sufficient number of slide preparations was available.

Information about geographical distribution is descriptively summarized and is ~~based on~~ material examined. Detailed distribution records are presented in the form of maps. In most instances, symbols on the maps represent locality records for specimens I personally examined; in a few instances, unverified records obtained from publications have been added to the maps when deemed potentially significant but are distinguished from confirmed records by different symbols.

Information about periods of flight is provided in general terms only (months being divided into early, mid- and late periods); earliest and latest seasonal records are stated for the entire known range if a species is confined to a region of relatively uniform climate and seasonal pattern, or for various parts of the range if a species is widely distributed, and its range includes a diversity of climates and seasonal patterns.

Information about hostplants was obtained directly from specimen labels. Published records of hostplants (which are few) were excluded unless they could be confirmed by cross-checking with the original specimens on which they were based. Except in very few instances, it was not possible to check or confirm the correctness of identification of hostplants recorded on specimen labels.

Newly described species. — New species are described only to allow the designation of type species for new genera. The format follows that used in the synopsis of previously described species. Label data for holotype and allotypes are cited in full as in the synopsis. Label data for other paratypes were treated less rigorously. Repositories are given in parentheses at the end of primary type citations and of each paratype series.

The section about type material is followed by an accurate citation of the type locality, description of the condition of the holotype and derivation of the specific epithet. Under "Recognition", in most instances only attributes distinguishing the type species from other undescribed members of the genus are given. Type species descriptions do not repeat non-varied attributes of the genus. Color attributes are described in detail whereas structural attributes are described only in their distinctive features relative to the generic description. Sections about variation, geographic distribution, period of flight and hostplants were treated as in the synopsis.

Genera. — For each genus, a synonymical list (if pertinent), citation of the type species, derivation of the generic name and a section about recognition (similar to that in the treatment of species) are provided.

Descriptions are divided into twelve subsections as follow: habitus, coloration, head, prothorax, mesothorax, metathorax, legs, wings, male abdomen, male genitalia, female abdomen and female genitalia. In the section about habitus, the general appearance and relative size of the moths is described. In the section on coloration, the predominant colors and color patterns of members of the genus are briefly described. Skeletal features and structural attributes other than those of the abdomen and genitalia were described from whole body preparations representing a limited number of taxa of each genus, listed under each respective genus. Skeletal features were not examined in two genera because of lack of material. Generic descriptions do not repeat non-varied attributes of other genera, except for abdomen and genitalia attributes. Structures of the abdomen and genitalia are so extraordinarily complex in Scythrididae that I found it virtually impossible to avoid being somewhat repetitious without rendering descriptions unintelligible. Attributes of a genus that were generally similar to those of another but differed only in details, were described as "… as in [genus] except …".

The separation of characters of male and female genitalia into those of generic value and those of specific value was difficult to make for monobasic genera. Concerning new monobasic genera for which the newly described type species appeared to be the only member (as opposed to new genera with only the type species described but with one or more undescribed species in collections), I have often been in a quandary about which attributes to include in the generic description versus which ones to place in the description of the new type species. I have adopted the following rule of thumb: all structural attributes of the body (head, thorax, wings, legs and pre-genital segments of the abdomen) were included in the generic description because such features usually vary little or not at all among species of a genus (this being based on known information about genera with several species); color attributes and structural features of male and female genitalia were included in the description of the type species. Some structural attributes of the pre-genital abdomen, such as unusual modifications of segments 6, 7 and 8 were placed in the generic description even though further study may show them to have specific value; this choice was motivated by the fact that in known genera with more than one species known (described or not), such modifications commonly have generic value.

The complex and unusual modifications of the sycthridid pre-genital abdomen and genitalia make it difficult to present description of these parts in a consistent format. This difficulty is best exemplified by the common occurrence of striking modifications of tergum 8 and/or sternum 8 in males, and even their fusion or very tight association with the genitalia. Such structures probably assume a functional role in the genitalia and hence, from that aspect, could be included in the genitalia description. I have elected to describe them with abdominal structures to facilitate comparison with taxa in which such structures are not modified.

In the section about monophyly and relationships, defining character states of a genus and information about related genera and position of the genus are summarily provided. In the section "Included species and generic diversity", a species list is given and includes new transfers (new combinations). If specimens representing other undescribed species are known to me, this is indicated in this section.

Information known to me about ranges of member species, described and undescribed, is provided in the section about geographical distribution. Finally, the section about natural history provides information about hostplants and life habits of adults and immatures, obtained from label data and from personal communications by collectors.

2.4 Terms

External features. — Color names used in the descriptions are those proposed in the *Naturalist's Color Guide* (Smithe 1975). Terms used for structures follow Common (1970). The expression **plical streak** refers to any color streak distinct from the surrounding ground color that is extended longitudinally on or along the medial fold of the forewing (*e.g.* Figs. 17, 20, 21, 27, 28, 32, 37). The expression **tibial brush** is used here to refer to the long hair-like scales of the outer (dorsal) surface of the hind tibia. **Anal tuft** is used to refer to the long, hair-like scales forming prominent tufts at the apex of the abdomen of males. The **frenum** refers to an accessory wing coupling mechanism present in many Scythrididae and composed of two sets of stiff, semi-erect, setiform scales, one set being situated on the ventral surface of the forewing near the hind margin in basal third, the other set being on the dorsal surface of the hindwing between Sc+R1 and Rs in basal third (Figs. 150-156, 159-161)[1].

Genitalic structures. — Terms for structures of male and female genitalia primarily follow Klots (1970), except as clarified below. Because of the complexity and uncertain homology of several parts of many scythridid genitalia, I have elected to use a restricted number of morphological terms to reduce the likelihood of creating a false impression of homologization for structures whose derivation is as yet little understood. Such is particularly true of sclerifications surrounding the aedeagus in males, and the ostium bursae in females. I concur with Klots (1970) that proposing a new morphological term for every structure that appears unique to the group under study is unwarranted, unless its homology is clearly understood; when encountered, such structures were merely referred to in descriptive terms. Reference to right and left sides are interpreted from a dorsal aspect with the anterior (basal) part pointed away from the observer; this also apply to observation of an entire moth.

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[1] I am indebted to R.W. Hodges for suggesting the term **frenum** to name this structure. This term has been used to refer to different structures in Odonata, Trichoptera and Heteroptera (Torre-Bueno 1978) but I am unaware of it having been previously used in reference to Lepidoptera structures.

Male genitalia. In many scythridids, it is difficult to ascertain whether an uncus and/or socii are present. In Lepidoptera, the **uncus** is defined as the caudal portion of tergum 10 and is usually a variously shaped, mid-dorsal process just above the anus (*e.g.* Figs. 185, 193, 203, 249), whereas the **socii**, when present, are paired, usually membranous and setose lobes on either side of the base of the uncus (Klots 1970) (*e.g.* Figs. 204, 214, 218). In many Scythrididae, there is a pair of elongate, heavily sclerotized and setose arms whose base is either dorsad or sublaterad of the anus (*e.g.* Figs. 264, 269, 273, 278). When these arms are present, there is no other mid-dorsal structure that would represent a more typical uncus, hence they could be either a divided uncus or elongate and sclerotized socii; I have termed them **socii** because they are paired and setose, albeit their size and degree of sclerotization are very unusual among ditrysian Lepidoptera.

The **gnathos**, or latero-ventral process(es) of sternum 10, is, in many Scythrididae, confusingly modified and asymmetrical (*e.g.* Figs. 237, 241), and in some specimens partly fused to the posterior edge of the tegumen (*e.g.* Figs. 252, 257). The gnathos was homologized based on its position relative to that of the anus, which is situated between the latero-basal processes of the gnathos. The paired, latero-basal processes of the gnathos surrounding the anal tube were termed **(paired) proximal arms**, and the medio-posterior process formed by the meeting and fusion of the proximal arms was termed the **distal arm** (*e.g.* Figs. 241, 261, 267, 269).

The terms **upper diaphragma** and **lower diaphragma** were used in some instances to refer to the portion of the diaphragma above and below the plane of the aedeagus, respectively. In most scythridids, the **aedeagus** is partly or completely immobilized by various sclerotizations that are either firmly attached but articulated, or fused, to its shaft; an aedeagus so immobilized was described as **ankylosed**. The term **juxta** was used to designate any sclerite, band or process attached ventrally to and ankylosing the aedeagus (*e.g.* Figs. 173, 185, 211, 213, 244, 259, 265, 284, 285,301). Structures designated as juxta are probably not homologous throughout the family, but use of the same term is useful to refer to structures with the same position and function. The term **bulbus ejaculatorius** is used in the sense of Sattler (1979) to designate the membranous sheath extended from the anterior portion of the aedeagus and surrounding the distal portion of the ductus ejaculatorius; in many Scythrididae, this sheath is expanded (*e.g.* Figs. 180, 203, 214, 227), strikingly so in many specimens (*e.g.* Figs. 233, 239, 244, 248), into a large, variously shaped sac. The term **phallotreme** was used to designate the distal opening of the endophallus near or at the apex of the aedeagus (Torre-Bueno 1978) (*e.g.* Figs. 173, 203, 226, 234, 259, 284, 295, 299). The term **fusion bridge** designates the medial region along which the valvae are fused (*e.g.* Figs. 214, 219, 225, 239, 247, 270, 274, 291, 296). The terms **cucullus** or **cucullar lobe** are used interchangeably to designate the distal setose lobe of the costa (dorsal edge) of the valvae (*e.g.* Figs. 173, 273, 277, 282, 295).

Female genitalia. Sclerotizations surrounding the ostium are extremely common in scythridids and present striking developments in many specimens, such as elaborate plates, elongate tubes or projections variously protruded from the ostium -bearing segments of the abdomen (*e.g.* Figs. 305, 311, 316-319, 322, 324, 337, 341, 343, 350, 362, 367). The inclusive term **sterigma** was used to described those (Klots 1970). Recently Bengtsson (1984) referred to 'lamella antevaginalis' and 'lamella postvaginalis' to designate sclerotizations anterior and posterior of the ostium of scythridid females respectively, but I found such a distinction to apply to so few species as to render it virtually useless. The term **ovipositor** was used to designate the portion of the abdomen caudad of the 8th segment, that is the 9+10th segment, bearing the papillae anales and ostium oviducti, and the intersegmental membrane between the 8th and the 9+10th segments (*e.g.* Figs. 307, 331).

Skeletal structures. — General works about Lepidoptera give only cursory treatments of the skeletal structures other than those of the abdomen and genitalia , and this undoubtedly reflects the rarity of morphological studies investigating those and the even greater rarity of systematic works describing them. Thus, to recognize and name structures of the head, thorax and abdominal base, I had to rely on comparison of various papers to obtain a comprehensive account.

Names of head structures and sulci follow Kristensen (1968), but indicate my own interpretation of which of them have been lost in the relatively advanced, ditrysian Scythrididae, compared to the primitive dacnonyphan taxa studied in Kristensen's work (Figs. 93, 94). Names of thoracic structures follow Davis (1986), except for the prothorax whose nomenclature of parts (Figs. 110-112) is a compound of that of Davis (1986) and of Minet (1984), because both are incomplete. Names of parts and sutures of the sterno-pleural region of the mesothorax follow Brock (1971) (Fig. 113). In the tergo-pleural region of the mesothorax, I use the term **trans-epimeral sulcus** to refer to a sulcus that demarcates the broad portion of the mesepimeron which extends along the pleural suture, from the narrow **dorsal arm of the mesepimeron** which extends dorsally to join the secondary arms of the furca (Figs. 129-131). Names that are of my own making, such as the above, are strictly descriptive [*e.g.* propleural ridge (Fig. 111), intercoxal lamella (Fig. 132)], and do not represent novel morphological interpretations; they were introduced when the pertinent structures showed intra-familial variation that needed to be described. Regarding structures of the abdominal base, use of the terms **venulae** and **apodemes** to refer to the abdominal sternal support system follows Hodges (1986: 7) (Figs. 170-172).

To count the number of flagellum articles on specimens whose whole body had not been prepared, antennae were prepared as follow: after being relaxed for a few minutes in a lukewarm 10% KOH solution, they were washed in 30% ethanol, mounted on a slide in a drop of glycerine and lightly pressed with a cover slip to remove part of the scales and allow the antennomeres to be seen; antennomeres were then counted under the compound microscope at a magnification of 40x. The antennae were then stored in glycerine-filled microvials pinned under their respective specimens.

Abbreviations. — References to individual terga or sterna are noted **T** or **S** followed by the segment number. For example, T3 and S5 mean tergum 3 and sternum 5, respectively; T2-T5 means terga 2 to 5. The intersegmental membrane connecting the dorsal or ventral parts of two segments is abbreviated **ISM** followed by the indication of tergum or sternum and the segment numbers. Thus ISM S7-S8 means intersegmental membrane connecting sterna 7 and 8; ISM T8-tegumen means intersegmental membrane connecting tergum 8 and the tegumen of the male genitalia. The symbol ± means "more or less".

2.5 Measurements and illustrations

Measurements and ratios, except for labial palps, were obtained with a Zeiss stereoscope at magnifications of 20, 40 or 80x, using an eyepiece micrometer with a scale interval of 0.05 mm at 20x. Because of their curvature, labial palps were measured from an image (obtained from a drawing tube mounted on a Nikon Optiphot microscope) projected on a Micro Plan II® electronic drawing board (Laboratory Computer Systems Inc., distributed by Nikon); the length of individual palpomeres was estimated by following the outer edge of their image with a calibrated electronic tracer connected to the board. The following measurements and abbreviations are used in descriptions:

1. **Forewing length (FL)**: maximum length of forewing from base to apex;

2. **Hindwing length (HL)**: maximum length of hindwing from base to apex;
3. **Wing expanse**: twice the maximum length of one forewing plus the width of the mesothorax measured along a transverse line at the level of the costa of the forewing; use of this method, instead of measuring directly the distance between the apices of both spread forewings, prevented differences in measurements that might have resulted from differences in angle of wings of differently set specimens;
4. **Forewing width (FW)**: maximum width of forewing;
5. **Labial palp length (LP)**: sum of the lengths of the three labial palpomeres, measured individually;
6. **Head height (HH)**: vertical distance between the fronto-clypeal ridge and the vertex, measured in lateral view; this measure was used to obtain the **LP/HH** ratio and thus was taken at the same magnification as that of the length of the labial palp (LP);
7. **Eye height**: maximum height of the eye, measured in lateral view;
8. **Interocular distance**: distance between the eye margins measured in frontal view midway between the ventral margin of the antennal sockets and the anterior tentorial pits;
9. **Interocular index**: ratio of eye height over the interocular distance (Davis 1975); this measure provides a good estimate of the relative eye size.

Qualitative statements of relative sizes and proportions (such as "long", "very short", etc.) of various structures other than those listed above were usually quantified by comparison with some other parts. For example, the length of T8 in males, or of the ovipositor in females, is given in relation to the length of T1-T7, which provides a good estimate of the relative proportions of these structures.

Line drawings of structural features were made with the aid of a drawing tube attached to either a Wild M5A stereoscope or a Nikon Optiphot microscope. Drawings are provided with scale bars, which were obtained by projecting the image of a stage micrometer through a drawing tube onto the drawings. On wing illustrations, dashed lines represent folds.

Photographs of moths were taken with a Nikon F3 camera fitted with a 55 mm macrolens and two extension rings. Specimens to be photographed were placed above a glass plate lighted by fluorescent light from beneath and by incandescent light from above. Specimens on regular insect pins were placed on a small blob of silicon glued to the glass plate; specimens on minuten pins were mounted on a syringe needle filled with modelling clay which was inserted in a blob of silicon on the glass plate.

Scanning electron micrographs were made with a Cambridge Steresocan 250 scanning electron microscope (SEM). Specimens to be photographed were prepared as described in section 2.2.5.

2.6 Taxonomic methods

2.6.1 Sorting of specimens

Because of the lack of revisionary work on Nearctic Scythrididae, lack of means to recognize described taxa, and the numerous undescribed taxa, I was faced with the difficult task of sorting the thousands of specimens available for study. While it was known from publications about the European fauna that genitalia offer an easy means of differentiation of species, and the few available dissections (slides from material borrowed) initially indicated this to be also true of Nearctic scythridids, a method of sorting was needed that would be faster that the fastidious making of hundreds of dissections on randomly selected specimens. Therefore the following method was used to allow relatively quick initial sorting.

Specimens were first sorted in series according to locality and date of collection. These were then arranged according to color, size and sex. Males were then further segregated according to differences in visible parts of the genitalia, by delicately brushing off, with a snipe feather under a stereoscope, the vestiture of scales covering the terminal portion of the abdomen to expose protruded parts of the genitalia. In most instances, sufficient details of the genitalia are made visible to readily differentiate morphotypes, that is groups with structurally different male genitalia. Female genitalia are mostly internal, hence removal of scales is usually of little help to segregate female specimens. Females were thus associated with males partly on the basis of similarity in color and size; several could be readily associated because they had been collected *in copulo* , or had been obtained from the same lot of reared larvae as males. A residue of a few hundreds unassociated female specimens was left after sorting. Many of these were subsequently dissected and associated with their respective males, or were associated with their respective males when, later in the study, external features became known to recognize them. The remainder was not included in this study.

Following sorting, each species lot was given a number and the genitalia of at least one male of each lot were dissected. If a lot included specimens from a wide range of localities and/or differently colored specimens, genitalia of a sample of them were also dissected. Lots were then re-assessed to ensure that they comprised specimens of only one species, and the genitalia of one female of each was dissected. It was not possible to attempt to dissect as many genitalia of females as of males due to time constraints; female dissection is far more time consuming than male dissection, because of the great fragility of the membranous parts.

2.6.2 Criteria for species recognition

The concept adopted here is that of the evolutionary species as expounded by Wiley (1981: 24). Evolutionary identity and reproductive isolation are inferred on the basis of phenetic divergence and geographical distribution. Forms differing in at least one structural attribute of either male or female genitalia and occurring sympatrically or allopatrically were considered separate species. Similar forms that differed only in color attributes and in mensural attributes of the genitalia (differences in proportions of otherwise similarly shaped structures) were considered separate species if those differences were the same in sympatry and in allopatry. Similar forms that differed in color and mensural attributes along geographical clines of more or less intermediate specimens, or from one geographical region to another without any distinct cline of intermediates, were recognized as belonging to a single species. Structural attributes of the genitalia of both sexes were given very high weight in species recognition. Other features such as coloration and wing venation were given low weight except when constant across populations and corroborated by other attributes (such as mensural attributes of the genitalia).

It was difficult to apply the species concept equally to all forms because of discrepancies in samples available for each. Many species recognized as valid in the synopsis are known only from one or a few adult specimens, and a few of them are even known only from individuals of one sex. On the other hand, some species are known from large series and from a wide range of localities. Subspecies were not used in this work.

2.6.3 Criteria for genus recognition

The concept of the genus adopted here is that of a mandatory category of the Linnean hierarchy containing one species or a monophyletic group composed of two or more species (Wiley 1981: 205). A monophyletic group was defined in its strict cladistic sense; that is, as a group that includes an ancestor, known or hypothesized, and all of its descendants (Wiley 1981: 76). To be regarded as monophyletic, a group of species had to share at least one autapomorphy (unique derived character state). Paraphyletic and polyphyletic genera were considered unacceptable in principle, although it is possible that some of the genera proposed here may later prove to be paraphyletic; in such a circumstance, generic limits would have to be re-assessed to make such genera monophyletic.

Within monophyletic groups, the recognition of genera adopted here is based on the following considerations: (1) distinctiveness from other monophyletic groups, and (2) degree of intrageneric morphological difference. These latter considerations amount to estimate or appreciate the morphological gaps and constitute the subjective part of taxonomic work. The only restriction on the use of gaps in a phylogenetic system is that they not be used to erect paraphyletic taxa (Wiley 1981: 249).

It is relatively easy to develop a concept of distinctiveness and morphological gaps within higher taxa such as families when at least some supra-specific classificatory structure is available, because one can assess how gaps were evaluated and translated into a classification by previous systematists. In establishing a phylogenetic classification, one then needs mainly to be concerned with evaluating whether the taxa are strictly monophyletic. This task is rendered difficult in the Scythrididae for two reasons: (1) no formal supraspecific classification was proposed previously and (2) the amount of structural divergence exhibited by genitalic structures, which are used principally in generic classificatory schemes of Lepidoptera, is staggering compared to what it is in other gelechioid families. Jäckh (1977a, 1978a, b) has reviewed some Palearctic species which he arranged into informal groups and Passerin d'Entrèves (1985) has provided the first review of the Palearctic genus *Enolmis* , but these works cover a very small fraction of the family and thus provide a very limited suggestion about how to construe generic limits in the family. If comparison with generic limits of other gelechioid families is used, then the amount of distinctiveness within the Scythrididae suggests a great number of generic entities, far greater in relation to the number of species than in other families of gelechioids. I have made such extra-familial comparisons, but in an attempt to prevent excessive splitting at this early stage of classification, I have construed genera to be as encompassing as possible within the bounds of the criterion of monophyly.

3. SYNOPSIS OF DESCRIBED SPECIES OF NEARCTIC SCYTHRIDIDAE

3.1 Recognition of family Scythrididae

Members of the family Scythrididae are recognized by the following diagnostic combination: (1) base of haustellum scaled (gelechioid character); (2) head scales closely appressed (so-called "smooth-scaled head" by many authors), very narrow (more than 10 times longer than wide (Figs. 65, 69, 70), except in *Areniscythris* with scales only 2-5 times longer than wide (Fig. 66) and with reduced tarsal spurs) and all oriented anteriorly and ventrally; (3) labial palpi with article 3 shorter than article 2 (Figs. 95-109, c), in most species palpi upcurved and extended to base of antennae or to level of vertex, in few species short and porrect or subporrect, articles 3 parallel to each other in dorsal or frontal aspect (Figs. 66, 69); (4) in Nearctic species (except the brachypterous *Areniscythris brachypteris* Powell, Fig. 24), R4 and R5 of forewing stalked, R4 extended to costa, R5 to termen (Figs. 150-161); (5) tarsomeres 1-4 with two subapical spurs (Figs. 79-81); (6) aedeagus ankylosed by juxta (*e.g.* Figs. 173, 199, 211, 213, 244, 265, 284, 285, 289, 299) or rigid diaphragma (Figs. 277, 279); (7) signum absent; (8) ductus bursae narrow or very narrow, at least in anterior half and at inception into corpus bursae (Figs. 372-400).

On the basis of external features only, many Scythrididae are somewhat difficult to separate from similar-looking Blastobasidae, Cosmopterigidae (*e.g. Anoncia*) and Symmocidae. There are subtle differences in habitus (overall body shape and proportions) which are rather difficult to describe but which enable someone with experience to immediately recognize scythridids: they are more pronouncedly teardrop-shaped, with more pointed wing apices and have an abdomen that extends at least two-thirds of the forewing length. Similar blastobasids, cosmopterigids and symmocids are more parallel-sided with rounded wing apices. Blastobasids also have a proportionally much shorter abdomen which is less than half the forewing length. North American scythridids are confidently separated from these similar gelechioids by the stalked and forked R4+R5 with R4 extended to costa and R5 to termen.

3.2 Keys to described species of Nearctic Scythrididae

3.2.1 Notes about the keys

Three keys are presented, one based largely on external features, especially color and color pattern, one based on male genitalia, and one based on female genitalia. Many species of scythridids are very difficult to identify based on external aspect alone, unless one has had considerable experience and seen many representatives of most species. Adults of several species are greatly varied in color and pattern, whereas those of many distinct species have very similar coloration. Most adult scythridids are rather somberly colored and differences in color are subtle and may not be appreciated in the same way by different people examining them under different lighting conditions. These factors complicate identification from external aspect alone. Adults of most species of scythridids however are easily and readily identifiable by aspect of the genitalia. Hence, examination of genitalia is frequently necessary to confirm determinations.

The key based on external features is presented for convenience. However, because of the large number of undescribed Nearctic species, many of which with similar aspect to those of described species herein, one should verify identifications by examining the genitalia. The great similarity and amount of variation of some closely related species also prevent their reliable separation on external features. Features of male and female genitalia that are easily visible externally (without dissection) are used in a few places in the key based on external features, wherever they help to choose between couplets better than external features do. These genitalia characters can be seen by denuding the apical portion of the abdomen of its scale cover. No damage to sclerotized structures occurs if denuding is carried under a stereoscope at a magnification of 10 to 25x, and if a very fine brush or snipe feather is used in light strokes. Use of a metal probe or needle must be avoided because such tools unavoidably damage the brittle cuticle.

Use of the keys based on genitalia necessitates dissection of the whole abdomen and genitalia. Because of the complex, highly tridimensional aspect of male genitalia of scythridids and, in many species, of extensive fusion of parts, and/or very dark sclerotization obscuring parts, it is preferable to run a specimen through the key while the dissected parts are in alcohol or glycerine, before mounting on a permanent slide. This allows free rotation of the genitalia so that all aspects can be better examined. After identity is established, one may decide about the best orientation on a permanent slide to optimize viewing of diagnostic characters. For identification of females, the shape of the inflated bursa should be sketched or drawn upon dissecting while in weak alcohol (15-30% ethanol), because the delicate sac will almost invariably collapse in concentrated alcohol or on permanent slide mount. Color and external features (such as size) are used in a few places in the keys based on genitalia where they facilitate the separation of species with somewhat similar genitalia.

3.2.2 Key based on external features

(Note: the male of *S. piratica* and the females of *S. charon*, *S. inornatella*, *S. perspicillella*, *S. planipenella*, *S. scintillifera*, and *S. suffusa* are unknown. *S. oxyplecta* is excluded from the key based on external features because no specimen of that species were examined).

1. Upper surface of forewings unicolorous, dark or pale 2

1'. Upper surface of forewings with at least some distinct spots, streaks or scattered scales differently colored from predominant ground color, or uniformly suffused with at least two colors 8

2.(1) Upper surface of forewings and most or all of body white or ivory-white............. 3

2'. Upper surface of forewings and body olive-brown, grey, grey-brown, or dark purplish-brown 4

3.(2) Haustellum very short, extended to prothorax, indistinct between labial palpi when coiled; male with sternum 8 enlarged, with long, upcurved apical furcation extended beyond apex of valvae (Figs. 177-178), and with tergum 8 (Fig. 190) barely extended to apex of uncus; female frenulum with three bristles ....*S. mixaula* Meyrick, p. 93

3'. Haustellum long, extended to about middle of abdomen, bulged and distinct between labial palpi when coiled; male with sternum 8 very reduced, indistinct at base of valvae, and with tergum 8 markedly enlarged and extended to apex of valvae (Figs. 280-281); female frenulum with two bristles......... *A. eburnea* Walsingham, p. 206

4.(2') Forewing upper surface ebony-black; antenna with proximal 2/3 to 3/4 distinctly thickened (Fig. 91); brush of hind tibia very long with hairs extended to apex of first tarsomere....................................*S. eboracensis* (Zeller), p. 119

4'. Forewing upper surface brassy, fuscous, olive-brown, or dark grey; antenna with flagellum filiform throughout (Fig. 92); hairs of hind tibial brush barely extended to base of first tarsomere, or shorter than tibia 5

5.(4') Forewing upper surface with marked brassy, golden, cupreous, or purplish lustre; visible part of male genitalia markedly asymmetrical; sternum 8 of male unmodified; sternum 7 of female caudally deeply emarginate or cleft with pincer-like or pointed projections (Figs. 332, 336, 338) 6

5'. Forewing upper surface dark grey, drab, or olive-brown, dull or with faint bluish or greenish hue; visible part of male genitalia symmetrical; sternum 8 of male markedly enlarged and extended beyond apex of valvae, with markedly upcurved, apically bifurcate process (Figs. 192, 193); sternum 7 of female with shallow caudal emargination and without projections (Fig. 310) .... *S. immaculatella* (Chambers), p. 87

6.(5) Right valva of male broad, incurved, covering apex of genitalia, and with outer side concave (Fig. 248) .... males of *S. scintillifera* Braun, p. 176

6'. Right valva of male wedge-like (Figs. 236, 239, 240, 241) or stubby (Figs. 233-235) 7

7.(6') Male genitalia very compact, shortened, recessed under tergum 8; female sternum 7 with caudal margin pointed and medially slit (Fig. 332) .... *S. graminivorella* Braun, p. 158

7'. Male genitalia with valvae extended beyond tergum 8; female sternum 7 emarginate and pincer-like (Figs. 336, 338) .... *S. matutella* (Chambers), p. 162, *S. impositella* (Zeller), p. 169

8.(1') Brachypterous, forewings barely extended to apex of, or shorter than, abdomen (Fig. 24) .... *A. brachypteris* Powell, p. 153

8'. Macropterous, forewings markedly extended beyond apex of abdomen 9

9.(8') Underside of forewing with one or a few streaks of shiny, indigo-black, markedly iridescent scales sharply contrasting with pale drab ground color; upper surface of hindwing with similar indigo-black streak along hind margin 10

9'. Underside of forewing and upper side of hindwing more or less uniformly pale or dark, without contrasting indigo-black scales 11

10.(9) Underside of hindwing with streaks or indigo-black scales and with veins white; abdominal terga ochreous-yellow, without black scales..................................
....females of *S. piratica* Meyrick, p. 143

10'. Underside of hindwing unicolorous white or very pale yellow; abdominal terga, at least in basal half, with indigo-black scales mixed with white scales....................
.... females of *S. anthracina* Braun, p. 108

11.(9') Females with three frenulum bristles 12

11'. Females with two frenulum bristles, or males 15

12.(11) Haustellum very short, extended to prothorax, indistinct between labial palpi when coiled ....females of *S. mixaula* Meyrick, p. 93

12'. Haustellum long, extended to abdomen, distinct between labial palpi when coiled
....1

3

13.(12') Abdominal terga olive-brown, brown, or drab, with hind margin contrastingly yellow or yellowish..............................females of *S. limbella* (Fabricius), p. 81

13'. Abdominal terga unicolorous, ochreous, ochreous-drab, or olive-brown, or if bicolorous then with lateral margins whitish 14

14.(13') Dark color of forewing olive-brown, or dark olive-brown, with moderate or faint brassy or purplish lustre; forewing without apical white spot; abdominal terga with lateral margins at most with few scattered pale or whitish scales, not contrastingly colored from medial area; widespread east of the Sierra Nevada to the Atlantic coast, north to southern British Columbia, and south to central México .... females of *S. trivinctella* (Zeller), p. 98

14'. Dark color of forewing drab or pale drab, with marked pale golden lustre; forewing with apical white spot; abdominal terga with lateral margins almost entirely white, contrasting with more darkly colored medial area; in California west of the Sierra Nevada.. females of *S. ypsilon* Braun, p. 104

15.(11') Wings with frenum consisting of single or double row of setiform scales near hind margin of underside of forewing, and on subcosta on upper surface of hindwing (Figs. 150-156, 159-161)..16

15'. Wings without frenum (Figs. 157-158)..39

16.(15) Haustellum very short, extended to prothorax, indistinct between labial palpi when coiled.. *S. mixaula* Meyrick, p. 93

16'. Haustellum long, extended to about middle of abdomen, bulged and distinct between labial palpi when coiled..17

17.(16') Forewing upper surface with distinct longitudinal streak in fold ("plical streak") extended from base to at least middle of wing and of paler color than that of surrounding disc area, without transverse fascia (Figs. 17, 20, 21, 27, 28, 32, 33, 37)..31

17'. Forewing upper surface without plical streak, variously suffused, mottled, fasciate, or maculate (Figs. 1, 2, 8-16, 25, 26, 29-31, 34, 39-44, 47, 55-56); if streaked, then streak basal and curved below fold toward hind margin (Figs. 45, 46), or with fine streaks elsewhere than in fold (Fig. 34); if with indistinct suggestion of plical streak, then with at least one fascia or spot in distal third (Fig. 45)....................18

18.(17') Forewing upper surface without trace of lines, spots, or fasciae, olive-brown, drab, or grey, and suffused with white, or white with olive-brown suffusion (Figs. 8, 25-26, 29-30, 56)..19

18'. Forewing upper surface variously colored, but with at least some distinct lines, streaks, spots or fasciae 22

19.(18) Wingspan < 12.5 mm 20

19'. Wingspan > 13.5 mm 21

20.(19) Small species (Figs. 25-26), wingspan < 10.5 mm; in arid parts of the southwest..... .... males of *S. anthracina* Braun, p. 108

20'. Medium species (Figs. 29-30), wingspan > 11.5 mm; in mountains of northern California .... males ofS. *suffusa* (Walsingham), p. 74

21.(19') Forewing upper surface olive-brown or grey-drab with moderately dense white suffusion over most of wing surface (Figs. 55-56); male tergum 8 enlarged as elongate, linguiform plate extended to apex of valvae (Fig. 216); apex of male valvae transverse, sickle-shaped (Fig. 219); female sterigma as very long tube (Fig. 322), its distal portion visible on left side without denuding abdomen.......................... .... *S. noricella* (Zeller), p. 135

21'. Forewing upper surface blackish with scattered white suffusion in distal half (Fig. 8); male tergum 8 not enlarged, crescentic (Fig. 215), indistinct if abdomen undissected; apex of valvae upcurved, prong-like (Figs. 213-214); female sterigma not readily visible without denuding apex of abdomen .... *S. inspersella* (Hübner), p. 129

22.(18') Large species with wingspan ≥ 16.5 mm.................. *S. noricella* (Zeller), p. 135

22'. Medium or medium-small species with wingspan < 16.5 mm......................... 23

23.(22') Forewing upper surface with pattern of fine longitudinal streaks, in some at most with very small dark dot in distal third (Fig. 34); body predominantly pale grey or whitish; hindwing upper surface pale grey 24

23'. Forewing upper surface with spotted or fasciate pattern (Figs. 1-2, 9-16, 29-31, 39-47); body predominantly brown or olive-brown; if body predominantly white or pale then forewing with two or three broad white fasciae, or hindwing upper surface brownish or olive-brown 25

24.(23) Dorsal surface of mesothorax uniformly drab or pale drab; forewing upper surface bicolored, ground color pale ochreous-drab, surface of veins finely streaked with white and only slightly contrasting with ground color...males of *S. planipenella* (Chambers), p. 193

24'. Dorsal surface of mesothorax medially grey or olive-brown, laterally contrastingly white; forewing upper surface at least tricolored, ground color white, grey or olive-brown, longitudinally streaked and with scattered suffusion of ochreous, drab, white or olive-brown..*S. fissirostris* Meyrick, p. 184

25.(23') Hindwing broad, medially almost as wide as middle of forewing, with posterior margin sinuate (Fig. 150); M2 and M3 of hindwing on common stalk (Fig. 150)...males of *S. limbella* (Fabricius), p. 81

25'. Hindwing narrow, medially distinctly narrower than middle of forewing, posterior margin straight or almost so (Fig. 152); M2 and M3 of hindwing separate (Fig. 152)..26

26.(25') Upper surface of forewing dull, with small, elongate, dark spots (Figs. 30-31)..27

26'. Upper surface of forewing with moderate or marked brassy, cupreous, or golden metallic lustre; if lustre slight or surface dull then with at least two broad white fasciae (Figs. 40, 41, 44, 47)..28

27.(26) Forewing upper surface of varied tones of pale yellowish-brown or drab, not suffused (Fig. 31).......................males of *S. perspicillella* (Walsingham), p. 71

27'. Forewing upper surface with olive-brown ground color more or less densely suffused with white (Figs. 29-30)........... males of *S. suffusa* (Walsingham), p. 74

28.(26') Males with tergum and sternum 7 enlarged, hood-like, covering genitalia (Figs. 197, 198, 202)..29

28'. Males with tergum and sternum 7 not enlarged, genitalia not covered, or females..30

29.(28) Forewing upper surface with darker color golden and with white apical fascia (Figs. 15-16); sternum 7 of males with apical projection laterally compressed and digitate (Figs. 201, 202); in California west of the Sierra Nevada..males of *S. ypsilon* Braun, p. 104

29'. Forewing upper surface with darker color olive-brown, apex whitout white fascia (Figs. 9, 11, 13); sternum 7 of males with apical projection simple, prong-like (Fig. 198); widespread east of the Sierra Nevada to the Atlantic coast, north to southern British Columbia, and south to central México..males of *S. trivinctella* (Zeller), p. 98

30.(28') Forewing upper surface with pale fasciae very indistinct (Fig. 39); male genitalia very compact, shortened (Figs. 234, 235), recessed under tergum 8; female sternum 7 with caudal margin pointed and medially slit (Fig. 332)...*S. graminivorella* Braun, p. 158

30'. Forewing upper surface with distinct, variously extended pale fasciae (Figs. 40-47); male genitalia with valvae extended beyond tergum 8 (Figs. 236, 239, 240, 241); female sternum 7 emarginate and pincer-like (Figs. 336, 338)...*S. impositella* (Zeller), p. 169, *S. matutella* (Clemens), p. 162

31.(17) Forewing upper surface dark or very dark brown with purplish hue, with plical streak golden and extended from base to about middle, and with golden or yellow mark at apex (Fig. 17); brush of hind tibia long, hairs extended to apex of first tarsomere...*S. basilaris* (Zeller), p. 113

31'. Forewing upper surface predominantly olive-brown, drab, grey-brown, dark brown, or pale ochreous, plical streak white, whitish, ochreous, or rufous, apex without golden mark; brush of hind tibia with hairs barely extended to base of first tarsomere, or shorter than tibia...32

32.(31') Forewing upper surface with plical streak distally bifurcate, branches extended to termen (Fig. 37)..*S. reducta* Braun, p. 180

32'. Forewing upper surface with plical streak distally simple (Figs. 20, 21, 27, 28, 32, 33), medially entire or interrupted 33

33.(32') Forewing upper surface with plical streak white, contrasting little with pale ochreous wing surface ....males of *S. inornatella* (Chambers), p. 146

33'. Forewing upper surface with plical streak white, ochreous or rufous, contrasting markedly with dark wing surface (Figs. 20, 21, 27, 28, 32, 33), or if little contrasting then wing surface predominantly olive-brown, brown, or grey (Fig. 35) 34

34.(33') Plical streak of forewing interrupted at middle of wing and continued as elongate spot near termen (Fig. 20)...*S. interrupta* Braun, p. 125

34'. Plical streak of forewing entire, extended to middle of wing or beyond 35

35.(34') Plical streak of forewing snowy white, narrow, sharply defined, extended from tegula to termen; rest of forewing upper surface olive-brown with scatered white suffusion (Fig. 21)..................................males of *S. charon* Meyrick, p. 149

35'. Plical streak of forewing ochreous, dark ochreous, drab, rufous, or yellowish mixed with some white, broad and somewhat ill-defined, not extended on tegula (Figs. 27, 28, 32, 33); rest of forewing upper surface variously suffused or streaked with at least two colors; if mostly unicolorous olive-brown then plical streak dark ochreous or drab, broad and ill-defined 36

36.(35') Upper surface of body predominantly pale grey or pale drab; forewing upper surface with several fine, white longitudinal streaks distally in area anterior to fold (Figs. 33, 34); cilia ochreous; hindwing upper surface pale grey; plical streak white, in most specimens with small dark dot in distal third; forewing slender with apex and spread cilia pointed ....*S. fissirostris* Meyrick, p. 184

36'. Upper surface of body predominantly olive-brown or dark; forewing upper surface in distal area anterior to fold unicolorous dark or variously suffused without streaks; cilia olive-brown; hindwing upper surface olive-brown or drab-brown; plical streak ochreous, yellowish, or rufous, without distal dark spot; forewing moderately broad with apex and spread cilia ± rounded..37

37.(36') Medium-large species with wingspan > 14.0 mm...........*S. altisierrae* Keifer, p. 77

37'. Medium-small or small with wingspan < 12.5 mm..38

38.(37') Male tergum 8 not enlarged, caudal margin with fan-shaped "brush" of slender scales (Figs. 174); apex of valvae as most apical part of genitalia; valvae distinct, moderately large (Fig. 173); female with caudal margin of sternum 7 medially straight; female sterigma, if visible, a flat, linguiform plate (Fig. 316)..*S. ochristriata* (Walsingham), p. 64

38'. Male tergum 8 enlarged as a slender, markedly tapered cone (Figs. 255) with apex as most apical part of genitalia; valvae reduced, indistinct; female with caudal margin of sternum 7 medially emarginate (Fig. 342); female sterigma, if visible, as elongate, subacuminate cone (Fig. 343)....................................*S. confinis* Braun, p. 189

39.(15') First abdominal tergum mostly devoid of scales except for small area in posterior half with few scales; male tergum 8 with long, narrow, digitate projection extended to apex of valvae (Figs. 266, 267); female with 7th abdominal segment laterally constricted, sternum 7 distally dilated, linguiform and wider than tergum 7 (Fig. 345)..*C. sponsella* Busck, p. 200

39'. First abdominal tergum completely covered with white or whitish scales; male tergum 8 broad, apically truncate with posterior angles pointed (Fig. 288); female with 7th abdominal segment straight-sided, sternum 7 as wide as tergum 7, not distally dilated..*S. divaricata* Braun, p. 211

3.2.3 Key based on male genitalia

(Note: the male of *S. piratica* is unknown).

1. Gnathos absent 2

1'. Gnathos present 9

2.(1) Valvae asymmetrical, prong-like, fused medially by a transverse bridge, costal margin submedially with asymmetrical, dorsally projected prong-like process (Figs. 213, 214) .... *S. inspersella* (Hübner), p. 129

2'. Valvae symmetrical, medially free, costal margin without submedial prong-like process 3

3.(2') Tergum 8 Y-shaped with caudal margin lined with dense, brush-like row of setiform scales (Figs. 174, 263); tegumen with latero-caudal margin produced into paired, heavy, beak-like processes ventrally lined with row or cluster of pegs (Figs. 173, 176, 179, 181, 182); uncus absent 4

3'. Tergum 8 quadrate or transversely rounded, caudal margin without brush-like row of setiform scales; tegumen without paired, beak-like processes; uncus horseshoe-shaped or as small, rounded lobes 7

4.(3) Valvae enormous, nearly as long as abdominal segments 2-7 combined, basal third of costal margin elevated, apex down-twisted181, 182) .... *S. altisierrae* (Keifer), p. 77

4'. Valvae not longer than half length of abdominal segments 2-7 combined, basal third of costa narrow, flat, apex straight and pointed, or bifurcate (Figs. 173, 176, 179) 5

5.(4') Valvae with cucullar lobe higher than wide and with apex bifurcate; beak-like processes of tegumen with 5-6 ventral pegs (Fig. 179) .... *S. perspicillella* (Walsingham), p. 71

5'. Valvae with cucullar lobe wider than high and with apex pointed; beak-like processes of tegumen with 11-18 ventral pegs (Figs. 173, 176) 6

6.(5') Valvae with apex broadly rounded, ventral margin with dentiform process anterior to apical projection (Fig. 176) .... *S. suffusa* (Walsingham), p. 74

6'. Valvae tapered caudad of cucullar lobe, ventral margin without, or with bare suggestion of, dentiform process anterior to apical projection (Fig. 173).. *S. ochristriata* (Walsingham), p. 64

7.(3') Sternum 8 with caudal margin medially protruded and apically notched (Fig. 212); valvae parallel, their bases widely separated, inner side of distal third with dense tuft of spiniform setae (Fig. 211).................................. *S. interrupta* Braun, p. 125

7'. Sternum 8 pincer-like (Figs. 205, 206, 209); valvae divergent, their bases proximate, inner side of distal third bare or with few scattered setae (Fig. 204)....................8

8.(7') Forewing upper surface very dark brown with golden or yellowish streak in fold extended from base to about one-third and a similarly colored patch at apex (Fig. 17); antenna with flagellum of uniform thickness throughout (Fig. 92); sternum 8 with anterior apodemes subparallel, separated by a distance subequal to maximum width of sternum, and with pincer-like caudal apodemes equal or longer than combined length of medial portion and anterior apodemes (Figs. 205, 206).. *S. basilaris* (Zeller), p. 113

8'. Forewing upper surface uniformly very dark brown or ebony black (Fig. 18); antenna with proximal 2/3 or 3/4 of flagellum distinctly thicker than distal portion (Figs. 91); sternum 8 with anterior apodemes separated by distance less than maximum width of sternum, and with pincer-like caudal apodemes distinctly shorter than combined length of medial portion and anterior apodemes (Fig. 209)... *S. eboracensis* (Zeller), p. 119

9(1'). 8th abdominal segment unmodified; genitalia symmetrical, small, compact, with stubby valvae (Fig. 225); gnathos thin, transluscent (Fig. 224)... *S. inornatella* (Chambers), p. 146

9'. 8th abdominal segment with tergum, or sternum, or both, markedly modified and differentiated from preceding segments; if 8th abdominal segment unmodified, then genitalia markedly asymmetrical and/or with markedly enlarged, thick gnathos.....10

10(9'). Sternum 8 markedly sclerotized and differentiated from preceding sterna, greatly enlarged and extended beneath genitalia beyond apex of valvae (Figs. 177, 178, 183, 184, 191-193, 197, 198, 200-202)..11

10'. Sternum 8 of similar shape and size to, or smaller than, preceding sterna, or if of differing shape then of about same size as preceding sterna and not, or barely, extended beneath genitalia 16

11(10). Sternum 8 divided into two valva-like halves, apices with dense tuft of stiff setae (Fig. 191); entire genitalia asymmetrical (Figs. 259-262); gnathos with medio-distal projection longer than genitalia, bent at right angle beneath it and extended cephalad beyond anterior margin of tegumen; valvae very short and stubby........................ ....*S. planipenella* (Chambers), p. 193

11'. Sternum 8 entire with caudal margin medially produced and without setae; genitalia symmetrical; gnathos with medio-distal projection much shorter than genitalia, straight or slightly curved, with apex projected ventrally or caudally; valvae elongate (Figs. 185, 187, 193, 194, 199)...12

12(11'). Tergum 8 about as large as, or larger than, sternum 8 (Figs. 197, 200)..............13

12'. Tergum 8 less than half size of sternum 8..14

13(12). Caudal margin of tergum 8 broadly, asymmetrically emarginate, with medial, ventrally projected, L-shaped process (Fig. 200); caudal projection of sternum 8 laterally compressed, broadened and digitate (Figs. 201, 202)............................ ....*S. ypsilon* Braun, p. 104

13'. Caudal margin of tergum 8 medially produced, projection with apex shallowly indented (Fig. 197); caudal projection of sternum 8 simple, prong-like (Fig. 198).... ....*S. trivinctella* (Zeller), p. 98

14(12'). Sternum 8 with branches of apical furcation very long, rod-like (Figs. 177, 178); gnathos spear-like (Figs. 187, 189); valvae in lateral aspect with proximal 2/3 narrow, distal 1/3 broad, rudder-like with inner surface densely setose (Fig. 187); aedeagus upcurved (Fig. 187) .... *S. mixaula* Meyrick, p. 93

14'. Sternum 8 with branches of apical furcation short (Figs. 184, 192); gnathos various but not spear-like; valvae in lateral aspect with proximal 2/3 as broad or broader than distal 1/3, inner surface distally glabrous or very sparsely setose (Figs. 185, 193); aedeagus straight or downcurved 15

15(14'). Sternum 8 with stem of furcation about as long as branches of furcation and slightly upcurved, branches of furcation parallel (Figs. 183, 184); apex of valvae downtwisted, tapered, costal margin medially slightly rounded (Figs. 185, 186) .... *S. limbella* (Fabricius), p. 81

15'. Sternum 8 with stem of furcation about 3x length of branches of furcation, abruptly and markedly upcurved, branches of furcation divergent (Figs. 192, 193); apex of valvae broadly dilated, spatulate, costal margin medially with dentiform process (Figs. 193) .... *S. immaculatella* (Chambers), p. 87

16(10'). Valvae with proximal half medially fused and apex sickle-shaped (Fig. 219); vinculum thick, ring-like, extended cephalad of base of valvae (Fig. 219) .... *S. noricella* (Zeller), p. 135

16'. Valvae separate or with only extreme base fused, apex tapered, rounded, truncate or lobate; vinculum small and indistinct, fused to base of valvae, or as posteriorly projected, irregularly shaped plate 17

17(16'). Valvae markedly asymmetrical 18

17'. Valvae symmetrical 23

18(17). Tergum 8 markedly enlarged and modified, as long as valvae, distally digitate (Figs. 266, 267); tegumen divided into two lateral halves by deep dorso-medial emargination (Fig. 264); aedeagus relatively large, distally sigmoid (Fig. 267); large, wingspan ≥ 18.0 mm .... *C. sponsella* Busck, p. 200

18'. Tergum 8 smaller than, or subequal in size to, preceding tergum, not modified; tegumen dorsally entire, dome-like, somewhat asymmetrical; aedeagus small, straight; small or medium-small, wingspan < 14.5 mm 19

19(18'). Medio-distal projection of gnathos heavy, markedly sclerotized, extended below valvae, apex subclavate and spined (Figs. 240, 243, 248) 20

19'. Medio-distal projection of gnathos thin, extended above valvae, apex tapered and smooth (Fig. 236), or membranous (Fig. 233), or absent (Fig. 247) 21

20(19). Right valva straight, distal 1/2 laterally compressed, blade-like (Figs. 240, 244); basal lobe of gnathos large, simple in left lateral aspect, with apex extended slightly beyond that of distal projection (Figs. 240, 241, 243) .... *S. impositella* (Zeller), p. 169

20'. Right valva markedly incurved and dilated; basal lobe of gnathos small, double in left lateral aspect, with apex distinctly anterior to that of distal projection (Fig. 248)....... .... *S. scintillifera* Braun, p. 176

21(19'). Valvae elongate, about as long as tegumen (Fig. 236); tegumen elongate-conical, longer than wide (Figs. 236, 238) .... *S. matutella* (Clemens), p. 162

21'. Valvae very stubby, markedly shorter than tegumen; tegumen subquadrate or hemispherical, about as long as wide (Figs. 233, 235, 245, 247) 22

22(21'). Bulbus ejaculatorius elongate, coiled 2-3 times, markedly longer than genitalia (Fig. 233); medio-distal projection of gnathos small, lobate shorter than valvae and not projected beyond their apex (Figs. 233, 234); tegumen subquadrate (Fig. 234)........ .... *S. graminivorella* Braun, p. 158

22'. Bulbus ejaculatorius subconical, shorter than genitalia (Fig. 247); medio-distal projection of gnathos prominent, spine-like, projected beyond apex of valvae (Figs. 245, 246); tegumen hemispherical (Figs. 245-247) .... *S. reducta* Braun, p. 180

23(17'). Medio-distal projection of gnathos very long, sinuate, extended far ventrad of valvae and apically hooked (Figs. 249, 257) 24

23'. Medio-distal projection of gnathos relatively short, not or barely extended below valvae (if shortly extended below valvae, then not apically hooked), or lacking...25

24(23). Tergum 8 conical, without apodemes, apex with ventral row of pegs (Fig. 255); uncus straight, cylindrical (Fig. 257); base of gnathos with very long, heavily sclerotized, acuminate, blade-like process extended beyond apex of uncus (Figs. 257, 258)..*S. confinis* Braun, p. 189

24'. Tergum 8 elongate-rectangular, with anterior and posterior angles prolonged into short apodemes, caudal margin without pegs (Fig. 253); uncus downcurved, ventrally lobate (Figs. 249); base of gnathos with short, ledge-like process not extended beyond apex of uncus (Figs. 249, 251)......*S. fissirostris* Meyrick, p. 184

25(23'). Caudal margin of tergum 8 with 3-6 caudally projected pegs (Fig. 223)..*S. anthracina* Braun, p. 108

25'. Caudal margin of tergum 8 without pegs..26

26(25'). Gnathos wishbone-like, latero-basal arms simple (Figs. 277, 285); large, wing expanse > 14.0 mm..27

26'. Gnathos with left latero-basal arms each with heavily sclerotized, anteriorly projected, spiniform process (Figs. 227, 231); small, wing expanse < 9.0 mm, or brachypterous...28

27(26). Tergum 8 plow-like, medially with heavy ventral process and with distal half narrow (Figs. 280, 281); socii as two long, narrow, ventrally bent rods; valvae with large, rounded, densely setose cucullar lobes (Figs. 277, 278)..*A. eburnea* Walsingham, p. 206

27'. Tergum 8 subtrapezoid, hood-like, apex broad, truncate, and in some specimens with latero-apical angles dentiform (Fig. 288); socii medially fused, distally horned (Figs. 285, 286); valvae without cucullar lobes (Fig. 285).......*S. divaricata* Braun, p. 211

28(26'). Gnathos with distal, sigmoid projection (Fig. 230); tergum 8 linguiform with anterior apodemes (Fig. 232)); brachypterous (Fig. 24)........*A. brachypteris* Powell, p. 153

28'. Gnathos without distal projection (Fig. 226); tergum 8 subconical, without anterior apodemes (Figs. 228, 229); macropterous (Fig. 21).......*S. charon* Meyrick, p. 149

3.2.4 Key based on female genitalia

(Note: the females of *S. charon* , *S. inornatella* , *S. perspicillella* , *S. planipenella* , *S. scintillifera* , and *S. suffusa* are unknown).

1. Caudal margin of sternum 7 medially with protruded, membranous, lobate appendix (Figs. 312, 345, 353, 362)..2

1'. Caudal margin of sternum 7 medially variously emarginate, rounded, with sclerotized projections, or entire...6

2.(1) Sterigma projected out of sternal wall, spout-like with invaginated anterior apodemes (Fig. 353)...................*S. divaricata* Braun, p. 211, *S. oxyplecta* Meyrick, p. 216

2'. Sterigma in plane of sternal wall and without anterior apodemes, or undeveloped.... 3

3.(2') Sternum 7 elongate, linguiform, with distal portion thickened, extended over basal portion of sternum 8 and covering ostium (Figs. 345, 346)); sternum 6 with antero-lateral arms extended dorsally and fused to anterior margin of tergum 6 (Fig. 344).... ....*C. sponsella* Busck, p. 200

3'. Sternum 7 broadly transverse or suborbicular, not extended over sternum 8, ostium uncovered; sternum 6 unmodified, without arms...4

4.(3') Distal portion of ductus bursae markedly dilated; ostium wide, on intersegmental membrane between sterna 7 and 8 (Fig. 364); large, with immaculate, ivory-white forewings (Figs. 49, 50)................................*A. eburnea* Walsingham, p. 206

4'. Distal portion of ductus bursae as narrow as, or slightly wider than, proximal portion; ostium small, on sternum 8 (Figs. 313, 315); small or medium-small species with maculate forewings (Figs. 9-16)..5

5.(4') Tergum 7 medially with marked transverse fold (Fig. 314); surface of sternum 8 mostly membranous (Fig. 315)..............................*S. ypsilon* Braun, p. 104

5'. Tergum 7 medially smooth or with very fine wrinkles; sternum 8 with transverse sclerotized band anterior to ostium and with marked transverse wrinkles (Fig. 313) ....*S. trivinctella* (Zeller), p. 98

6.(1') Ostium at apex of conical, tubular, or triangular sterigma projected out of sternal wall (Figs. 305, 316-319, 321, 322, 324, 333, 335, 337, 339, 341, 343)................7

6'. Ostium , and sterigma if developed, in sternal wall (Figs. 307, 311, 326, 330, 331). 21

7.(6) Sterigma inserted on anterior margin of sternum 7...8

7'. Sterigma inserted on sternum 8 or on membrane between sterna 7 and 8..............9

8.(7) Sterigma longer than segments 7 and 8 combined, narrowly tubular, base anchor-shaped, apex straight (Fig. 322)..............................*S. noricella* (Zeller), p. 135

8'. Sterigma about 0.5 to 0.7 length of segments 7 and 8 combined, medially dilated, base rhomboid, apex curved leftward (Fig. 324, 325)...................................... ....*S. inspersella* (Hübner), p. 129

9.(7') Apex of sterigma and ostium directed anteriorly.......................................10

9'. Apex of sterigma and ostium directed posteriorly, laterally, or ventrally.............12

10.(9) Sterigma linguiform with apex broad, rounded (Fig. 316)................................ ....*S. ochristriata* (Walsingham), p. 64

10'. Sterigma conical with apex tapered (Figs. 317, 335)....................................11

11.(10') Cone of sterigma inserted on a sclerotized oval plate on wall of sternum 8 (Fig. 317); segment 8 about as long as ovipositor..........................*S. altisierrae* Keifer, p. 77

11'. Cone of sterigma inserted on membranous wall of sternum 8 (Fig. 335); segment 8 distinctly shorter than ovipositor................................*S. reducta* Braun, p. 180

12.(9') Distal half of ductus bursae distinctly sclerotized and irregularly twisted (Fig. 321)... ....*S. interrupta* Braun, p. 125

12'. Ductus bursae entirely membranous..13

13.(12') Sterigma flat, semicircular or trapezoid, projected from narrow, lightly sclerotized anterior plate with sinuate sides (Fig. 305)...............*S. limbella* (Fabricius), p. 81

13'. Sterigma rounded, conical or tubular, if inserted on plate then plate broad and/or with parallel sides..14

14.(13') Sternum 7 medially with shallow, crescentic invagination (Figs. 340, 342).........15

14'. Sternum 7 without medial invagination..16

15.(14) Sterigma shaped as elongate, pointed cone inserted on membrane between sterna 7 and 8 (Fig. 343); hind margin of sternum 7 with tuft of setiform scales on each side of emargination (Fig. 342)....................................*S. confinis* Braun, p. 189

15'. Sterigma shaped as short, truncate cone inserted inside deep emargination of caudal margin of sternum 8 (Fig. 341); hind margin of sternum 7 without setiform scales (Fig. 340)..*S. fissirostris* Meyrick, p. 184

16.(14') Sternum 7 transversely rectangular, hind margin with very shallow or broad, rounded emargination (Figs. 318, 319); sterigma about as long as sternum 7....... 17

16'. Sternum 7 triangular or trapezoid, longer than wide (Figs. 332, 334, 336, 338); sterigma distinctly shorter than sternum 7 18

17.(16) Hind margin of sternum 7 with broad, relatively deep, rounded emargination; sterigma conical, apex narrowly tapered (Fig. 318).......*S. basilaris* (Zeller), p. 113

17'. Hind margin of sternum 7 with very shallow, irregular emargination; sterigma tubular, apex truncate (Fig. 319).........................*S. eboracensis* (Zeller), p. 119

18.(16') Hind margin of sternum with very shallow, rounded emargination and with very small projections (Fig. 334)......................................*S. reducta* Braun, p. 180

18'. Hind margin of sternum 7 with relatively deep, rounded or slit-like emargination and with marked, pincer-like projections (Figs. 332, 336, 338))........................19

19.(18') Hind margin of sternum 7 with narrow, slit-like emargination, apex with straight projections (Fig. 332); bursa elongate (Fig. 387).... *S. graminivorella* Braun, p. 158

19'. Hind margin of sternum 7 with rounded emargination, pincer-like projections incurved, convergent (Figs. 336, 338); bursa spherical (Figs. 388, 389)...........20

20.(19') Pincer-like projections of sternum 7 broad (Fig. 336); sterigma cone broad, blunt (Fig. 337)... *S. matutella* (Clemens), p. 162

20'. Pincer-like projections of sternum 7 narrow (Figs. 338); sterigma cone elongate and subacuminate (Fig. 339))................................. *S. impositella* (Zeller), p. 169

21.(6') Intersegmental membranes of terga 3-7 medially with deep invagination filled with scales (Fig. 327)... *S. anthracina* Braun, p. 108

21'. Intersegmental membranes of terga without scale-filled invaginations................22

22.(21') Tergum 7 shorter than sternum 7 and with antero-lateral angles prolonged on pleura as narrow rods (Figs. 306, 309).............................. *S. mixaula* Meyrick, p. 93

22'. Tergum 7 equal or longer than sternum 7, antero-lateral angles not prolonged into rods..23

23.(22') Caudal margin of sternum 7 folded inwardly and with broad, relatively deep emargination, with small, paired globular structures inside emargination, and with lateral angles protruded (Fig. 328)............................ *S. piratica* Meyrick, p. 143

23'. Caudal margin of sternum 7 very shallowly emarginate (Fig. 310), or rounded, without paired globular structures, lateral angles not protruded........................24

24.(23') Ostium on oval, concave plate medio-distally on sternum 8 (Fig. 311); caudal margin of sternum 7 shallowly emarginate (Fig. 310); macropterous............................
.... *S. immaculatella* (Chambers), p. 87

24'. Ostium on left antero-lateral part of sternum 8 and partly surrounded by narrow, L-shaped sclerite (Fig. 331); caudal margin of sternum 7 rounded; brachypterous (Fig. 24).. *A. brachypteris* Powell, p. 153

3.3 Classification of described species of Nearctic Scythrididae

3.3.1 *Scythris ochristriata* (Walsingham)

(Figs. 27, 28, 173, 174, 175, 316, 377, 419)

Butalis ochristriata Walshingham, 1888: 115.— Smith, 1891: 107 [checklist].

Scythris ochristriata ; Dyar, 1902: 538 [catalogue].— Smith, 1903: 117 [checklist].— Barnes and McDunnough, 1917: 190 [checklist].— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist].

Type material. — Type material in BMNH and not examined. Powell (pers. comm.) has examined the type series, labelled one male as lectotype, and dissected its genitalia as well as that of another male syntype. I examined a sketch of the lectotype genitalia.

Type locality. — Sheep Rock (about 15 km north of Mount Shasta), Siskiyou Co., California.

Recognition. — Adults are medium-small to small scythridids with pale olive-brown or drab to dark brown forewing with an ochreous streak in the cubital fold extended from base to half or 3/4 of forewing length (Figs. 27-28) and which is somewhat indistinct in some dark specimens. Similar in color and color pattern of forewings and/or male genitalia to *S. suffusa* and to at least four other undescribed species belonging to the same genus and occurring in California or the Pacific northwest. Adults are best distinguished from those of these species by features of male genitalia, in having the apical margin of valvae almost straight, the ventro-apical projection of valvae simple and nearly straight, and the fultural process protruded to a sharp, subpointed ledge (Fig. 173).

Description. — The following description is taken from specimens collected at Antioch National Wildlife Refuge, Contra Costa Co., California, which Powell (pers. comm.) has compared with the lectotype and regards as conspecific with it, based on similarity in male genitalia.

Size. Forewing length 4.3 - 5.4 mm; hindwing length 3.7 - 5.0 mm; wing expanse 9.6 - 12.0 mm (8 specimens).

Head. Face and vertex drab to olive-brown; clypeal area whitish; anterior and posterior margin of eye with narrow band of whitish scales widened on occiput behind antennal socket. Neck tufts white. Eye of moderate size, narrower than frons. Haustellum base with white, or white to pale olive-brown scales. Maxillary palpi conspicuous, folded over haustellum base, their apices almost contiguous; white with few light buff scales medially. Labial palpi mostly white; ventral surface of article 3 and distal half of article 2 olive-brown. Antenna about two-third length of forewing, dorsal surface unicolorous light olive-brown; ventral surface of scape, pedicel and first few articles of flagellum white; cilia short but clearly distinct at magnification of 50x.

Thorax. Collar medially pale olive-brown, laterally pale buff to whitish. Tegulae basally pale olive-brown, distally with mixed pale buff to whitish scales. Mesoscutum and mesoscutellum brownish-olive medially, whitish laterally. Ventral surface of thorax white. In dark specimens, dorsal surface of mesothorax mostly dark olive-brown with a few scattered paler scales. Legs. Fore- and midlegs with outer surfaces olive-brown, inner surfaces lightly suffused with drab or mostly whitish. Hindleg mostly white, tarsus darker, predominantly buff to clay-

Wings. Frenum present, Forewing with upper surface in darker specimens (Fig. 28) mostly olive-brown or brownish-olive, with ochreous or buff streak in fold extended from base of wing to about middle of wing; distal third of wing slightly suffused with greyish scales; in lighter specimens (Fig. 27), streak light buff or whitish, broad and irregular, extended to termen in some specimens, and/or posterior edge of large pale streak with short, narrow, interrupted dark brown streaks; dark portions of wing heavily suffused with pale buff to white scales; ventral surface drab, except costa whitish to light buff in distal half; cilia brown. Hindwing with upper surface unicolorous brown; ventral surface drab; cilia brown; female frenulum with two bristles.

Abdomen. Dorsal surface drab to olivaceous in males; paler, clay-colored to drab in females. Ventral surface whitish with interspersed greyish scales in males, white to whitish with light buff tone in females; ultimate segment (7th in females, 8th and valvae in males) ventrally buff yellowish in both sexes. Terga and sterna (as seen in potash-cleared specimens) transverse, markedly sclerotized in males, moderately so in females. In males, S2-S3 with caudal margin overlapped by anterior margin of next sternum, each with small "fenestra" near postero-lateral angle; S3-S4 each with small tubercule near antero-lateral angle, in proximity of fenestra of preceding sternum. Segment 7 unmodified in males; in females, about twice longer than preceding segments. T7 subquadrate, anterior portion moderately expanded laterally. S7 subquadrate, medially divided by longitudinal unmelanized area.

Male genitalia (Figs. 173-175). Symmetrical. T8 (Fig. 174) mostly membranous, folded inwardly on itself, portion inside abdomen with narrow, Y-shaped sclerotization extended from caudal margin under fold and inside abdomen to level of caudal margin of T7; double arm of Y bent laterally; sclerotization thicker, ± ridge-like medially, surrounded by narrow zone of weaker sclerotization. Caudal margin lip-like, with apical fan-shaped tuft of hair-like scales subequal in length to tergum. Pleural lobes moderately developed, with tufts of dehiscent hair-like scales. Intersegmental membrane T8-T9 normal, undeveloped. S8 (Fig. 175) markedly sclerotized, relatively heavy, transverse, slightly convex, sides bent dorsad; antero-lateral angles prolonged into heavy apodemes extended inside abdomen to level of anterior margin of S7. Tegumen (Fig. 173) transversely convex, lateral portions "deep" and ventro-caudally protruded into narrow projection articulated with vinculum; anterior margin deeply U-emarginate dorso-medially; latero-posterior margin protruded into two broadly separated, parallel, beak-like processes subequal in length to tegumen, dorsally humped with cluster of long, stiff, erect setae; ventral edge narrow, straight, with irregular single to double row of 11-18 tooth-like pegs; caudal portion inwardly oblique; apical edge subtruncate, with medial pit (gland opening); each process with internal, pouch-like gland extended into tegumen cavity, gland duct sclerotized distally to opening. Gnathos lacking. Vinculum U-shaped, vertical, arms sinuate, slightly bent caudad; base of each arm somewhat dilated into scoop-shaped flap into which valva base fits. Valvae free, articulated onto vinculum, longer than tegumen-uncus, recurved inward with apices subcontiguous in unspread position; proximal two-thirds narrow, subcylindrical; distal third of costa dilated into large cucullar, densely setose lobe; apical portion of ventral margin prolonged into narrow, slender, slightly recurved and blunt point. Juxta markedly sclerotized, shield-like, protruded caudad into prominent broad, sharp ridge, ledge-like in lateral aspect, and with apex finely sculptured (scabrous); margin antero-dorsal to ledge medially produced into two vertical, darkly sclerotized, contiguous conical projections, and laterally produced into pointed projection abutted to setose lobe of diaphragm just below base of uncus arm; medio-laterally produced into internal ridge fused to dorsal apex of vinculum arm. Aedeagus ankylosed to thick bar fused to inside of distal projection of juxta, bar expanded into ridge, cephalic apex attached ventrally to bulbous base of aedeagus; aedeagus very short, bulbous, deeply recessed; apico-laterally emarginate around phallotreme, dorso-apical margin lip-like, markedly sclerotized; phallotreme broad, caudo-ventral; bulbous ejaculatorius enlarged, larger than aedeagus, suboval in outline, with small anterior projection.

Female genitalia (Figs. 316, 377). Segment 8 subequal in length to segment 7. T8 elongate-rectangular, caudal 3/4 with a broad, medially thinly sclerotized to nearly membranous, indistinct area; apical margin lined with a few scattered fine setae; cuticle with very fine longitudinal striulae. S8 (Fig. 316) membranous, except for sterigma, medially concave under distal portion of sterigma. Sterigma base situated near caudal margin of S8, shaped as ovoid or linguiform, flattened cone with apex oriented cephalad; basal half indistinctly delineated, gradually merged with surrounding membrane of S8, with single erect seta on each side; distal overhanging below (ventrad of) of invagination of S8 membrane. Ostium at apex of sterigma, medial, pointing cephalad. Ductus bursae with antrum indistinctly sclerotized over short distance along length of distal half of sterigma; membranous portion of ductus flat, ribbon-like, inception into corpus bursae near anterior end of bursa. Corpus bursae (Fig. 377) entirely membranous, delicate, elongate, probably subcylindrical with a dilated anterior portion, protruded on one side, (bursa could not be fully inflated in specimens examined). Origin of ductus seminalis at caudal end of bursa. Spermatheca with main body simple, bent at acute angle. Anterior apophyses relatively thin, slightly divergent, attached to antero-lateral angle of T8 and not extended on it beyond their point of junction. Posterior apophyses about 1.75x length of, and as thin as, anterior apophyses. Ovipositor relatively short, about 2x length of T8 (less than 1/2 length of abdomen (T1-T7); papillae anales broad, not tapered, sparsely setose, very lightly sclerotized latero-basally in area of insertion of anterior apophyses, otherwise membranous.

Variation. — Specimens from the spring (April) generation from Antioch have predominantly dark brown forewings (Fig. 28). Individuals of the late summer (August and September) generation have a much paler greyish or whitish appearance due to more extensive suffusion of whitish and to greyer ground color (Fig. 27).

On tergum 8 of male specimens, the single distal arm of the Y-shaped sclerotization varies from thinly tapered or slightly broadened distally to broader than the paired basal arms. Tooth-like pegs of the uncus beaks vary from 11 or 11-12, rather widely separated and unevenly spaced, to 16-18, closely set, more or less evenly spaced. Cucullar lobes of valvae vary from regularly elevated and subconical to distally broad with more abruptly elevated sides. Apical projection of the valvae varies from slightly upcurved and apically rounded to straight and pointed. Ventral margin of valvae at base of apical projection varies from slightly to markedly notched; in the latter, distal portion of valva broad, straight or distinctly sinuate.

Variation in female genitalia was not examined.

With the original description of *S. ochristriata*, Walsingham (1888: 115) also discussed two "varieties" which he referred to as A and B and which differed in color from the nominal type material. Powell (pers. comm.) examined the male genitalia of Walsingham's specimens of these forms in BMNH and found that variety A differed slightly and might be a closely related species, whereas variety B differed markedly and could belong elsewhere.

I have examined one male of variety A, and one male and one female of variety B from Walsingham's original series (in USNM). The variety A male is without the metathorax, hindwings and abdomen; however its forewing coloration is similar to that of other members of the *ochristriata* complex in having a buff-ochreous streak in the fold extending to about 2/3 length of the wing. The variety B male is smaller than the nominal form, and also belongs to the *ochristriata* complex based on similarities in male genitalia, but differs enough in details that it might represent a distinct species: the uncus "beaks" are shorter, bent ventrad, with only three or four pegs, the glandular foveae are much wider, the medial projection of the fultura inferior is much more protruded caudad, larger, rounded and lobate, and the valvae are broader, heavier, with wider cucullar lobes. The variety B female has uniformly greyish-brown forewing but is without the abdomen, thus its identity cannot be assessed.

Phylogenetic relationships. — This species is not a *Scythris s. str.*, but belongs to a very distinct, speciose genus (see section 4.4) whose member species are mostly distributed in mountainous regions of western North America. Close Nearctic relatives of *S. ochristriata* that are described are *S. perspicillella* (Walsingham), *S. suffusa* (Walsingham) and *S. altisierrae* (Keifer).

Geographical distribution and seasonal occurrence. — Known only from two widely separated localities in northern California, the type locality and Antioch National Wildlife Refuge, Contra Costa Co (Fig. 419). Undoubtedly the species is more widespread, at least in northern California, and other records may be in collections, but it is not possible at present to assign specimens from other localities to this species because extent of variation in diagnostic characters of male genitalia has yet to be assessed.

At Antioch National Wildlife Refuge, Powell (pers. comm.) has observed two generations, a spring one whose adults fly in April, and an autumn one whose adults fly in August and September. Syntypes from Mt. Shasta were collected in August.

Hostplant. — At Antioch, larvae were reared from *Lupinus albifrons* (Fabaceae). Adults are diurnal and were found at various flowers, including *Eriogonum nudum* (Polygonaceae), *Croton californicus* (Euphorbiaceae), *Erysimum capitatum* (Cruciferae), and *Grindelia camporum* (Compositae).

3.3.2 *Scythris perspicillella* (Walsingham)

(Figs. 31, 179, 419)

Butalis perspicillella Walsingham, 1888: 114.

Butalis perspicelella [sic]; Smith, 1891: 107 [checklist, misspelled reference to *perspicillella*]

Scythris perspicelella [sic]; Dyar, 1902: 538 [catalogue].— Smith, 1903: 117 [checklist].— McDunnough, 1939: 91 [checklist] [all citations are misspelled references to *perspicillella*].

Scythris perspicellella [sic]; Hodges *et al.*, 1983: 19 [checklist, misspelled reference to *perspicillella*].

Type material examined. — HOLOTYPE male in USNM, labelled: "Folsom/ 15/ 7 85 Cal" [small, white, handwritten]; "166" [handwritten]; "BUTALIS/ PERSPICILLELLA/ Wlsm. MS. Type" [white, handwritten by Walsingham; the word "Type" seems to have been written by a different hand, possibly by Busck, who dissected the specimen]; "This has interested me/ much as differing from all/ I know from Cal. or elsewhere./ I have written a description/ and placed on it a MS. name/ which can be published at/ any time if desired./ Wlsm / 86" [a one square-inch piece of paper folded into four, written by Walshingham]; "[male symbol] genitalia/ on slide/ AB Jun 22 1927" ; "HOLOTYPE" [red, printed, added by me]. The abdomen and the genitalia were dissected by Busck and are mounted on a slide labelled: "Scythris/ perspicelella [sic]/ Type Wlsm/ Folsom Calif. 1885/ AB Jun 22 1927".

The collection date of the holotype is erroneously cited as "15, 4, 85" by Walsingham (*loc. cit.*).

Type locality. — Folsom, Sacramento Co., California.

Recognition. — A small scythridid with the upper surface of forewings pale yellowish drab with a few very short darker streaks (Fig. 31). Characters of male genitalia (Fig. 179) indicate that it belongs to the same group as *S. ochristriata* (T8 Y-shaped; S8 transverse with thick antero-lateral apodemes extended into abdomen; tegumen with paired, beak-like processes with ventral teeth and glandular foveae; juxta-aedeagus complex similarly shaped). It is distinguished from *S. ochristriata* and other related species by the high and narrow cucullar lobe of valva, bifurcate apex of valva, slender tegumen processes with five to six scattered teeth and lobiform, more protruded medio-caudal projection of juxta.

Description. — Size (of holotype). Forewing length 4.2 mm; hindwing length 3.6 mm; wing expanse 9.6 mm.

Head. Face medially drab with slight metallic reflection, white around antennal sockets, eyes and at occiput. Relative eye size as in *S. ochristriata*. Haustellum base covered with whitish scales. Maxillary palpi with four articles, short, not bent over base of haustellum. Labial palpi with apex to level of vertex, white except ventral portion of distal half rufous brown. Antennae moderately short, about half length of forewing, drab.

Thorax. Dorsal surface pale drab; mesoscutum with slight iridescence. Ventral surface whitish. Legs whitish except tarsi light drab.

Wings. Forewing broadly lanceolate; upper surface pale whitish drab, portion posterior to cubital fold olive brown, with two very short brownish streaks medially just behind fold and third short streak anterior to fold; termen olive brown at base of cilia; apical portion with small, somewhat indistinct brownish spot; cilia drab. Hindwing short, subtriangular; upper surface purplish fuscous, slightly iridescent; cilia drab. Ventral surface of both wings buff drab with marked iridescent hue.

Abdomen "iridescent purplish fuscous above; the lateral appendages on the ultimate segment [= apical tufts] whitish ochreous" (Walsingham 1888: 114). Color of abdomen not seen because it was dissected by Busck in 1927). Terga and sterna (as seen in potash-cleared specimen) similar to those of *S. ochristriata.*

Male genitalia (Fig. 179) similar to those of *S. ochristriata* except as follow: Tegumen (markedly deformed on Busck's slide) with antero-dorsal margin seemingly entire; tegumen processes more slender, sublanceolate; erect setae of dorsal hump darkly pigmented; ventral tooth-like pegs five or six spread out in single row. Caudo-medial process of juxta larger, more protruded, distally lobiform, apex dorsally creased. Valva with cucullar lobe relatively narrow and high, more prominent; apical portion bifurcate.

Female genitalia unknown.

Note: On Busck's slide, the genitalia are oriented with the ventral side up at an awkward oblique angle, which makes comparison with other genitalia preparations difficult. Moreover Busck's attempt to spread the genitalia resulted in a deformed and cracked tegumen, and deformed vinculum, fultura inferior and sclerites around the aedeagus.

Variation. — Unknown. The holotype is the only known specimen.

Phylogenetic relationships. — This species belongs to the same genus as *S. ochristriata* , to which species it is closely related.

Geographical distribution and period of flight. — Presently known only from the type locality (Fig. 419). Extent of period of flight unknown. The single known male was collected in July.

Hostplant. — Unknown.

3.3.3 *Scythris suffusa* (Walsingham)

(Figs. 29-30, 176, 419)

Butalis suffusa Walsingham, 1888: 114.— Smith, 1891: 107 [checklist].

Scythris suffusa ; Dyar, 1902: 538 [catalogue].— Smith, 1903: 117 [checklist].— Barnes and McDunnough, 1917: 190 [checklist].— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist].

Type material examined. — HOLOTYPE, a male according to Walsingham, in BMNH and not examined. PARATYPES, six males according to Walsingham. I examined two of them, in USNM, labelled:

Male 1: "[male symbol]" [very small, handwritten]; [small green circle]; "37 | 1889/ WLSM. COLL." [with pale purple double border, partly handwritten, partly printed]; "Mt. Shasta/ Siskiyou Co/ Cal. Wlsm 471/ viii. 1871" [handwritten by Walsingham]; "Butalis/ suffusa/ Wlsm." [handwritten by Wlsm.]; "[male symbol] genitalia on/ slide no./ JFL-85-0365/ by J.F. Landry/ USNM coll." [green, partly printed, partly handwritten, added by me]; "PARATYPE" and on reverse "This label was added by/ J.F. Landry, 1985" [yellow, typed on top, handwritten on back]; "Return to/ U.S. Nat. Mus." [yellow, printed, added by me].

Male 2: "[male symbol]" [very small, handwritten]; "Butalis/ suffusa/ Wlsm." [handwritten by Wlsm.]; "Mt. Shasta/ Siskiyou Co./ CALIFORNIA/ 2.viii.-1.ix.1871/ Wlsm." [printed]; "[male symbol] genitalia/ on slide/ AB May 14 1927" [white with black border, handwritten by Busck]; "PARATYPE" and on back "This label was added by/ J.F. Landry, 1985" [yellow, typed on top, handwritten on back]; "Return to/ U.S. Nat. Mus." [yellow, printed, added by me]; "AB 95" [green, typed, added by me for quick reference to Busck's slide].

Walsingham (*loc. cit.*) indicated that he collected six males in August 1871 at the type locality. Evidence from the original description and the labels indicates that the two specimens mentioned above are part of the type material despite lack of paratype designation on the labels. They agree in all characteristics with the original description.

Type locality. — Mount Shasta, Siskiyou Co., California.

Recognition. — Adults are small-medium scythridids of varied coloration with upper surface of forewing olive-brown suffused with whitish (Fig. 29), or mostly pale whitish with light brown suffusion (Fig. 30), and uniformly brown hindwing. Male genitalia (Fig. 176) are mostly similar to those of *S. ochristriata* and related species. Adults of *S. suffusa* are distinguished from them by the larger, distally broad valvae with a small accessory ventral process anterior to the apical projection, the roundly protruded apical margin of valva, and the evenly rounded, moderately protruding medio-caudal projection of the juxta.

Description. — The description is based on the only two paratypes I have examined. Description of abdominal color was made prior to dissecting the genitalia of male 1 (dark specimen).

Size. Forewing length 5.3-5.5 mm; hindwing length 4.7-5.0 mm; wing expanse 11.8-12.4 mm (2 specimens).

Head. Ground color fuscous brown suffused with whitish or whitish with light brown suffusion in occipital area. Relative eye size as in *S. ochristriata*. Haustellum base with mixed fuscous brown and whitish scales, or mostly whitish. Maxillary palpi as in *S. ochristriata*. Labial palpi with basal half whitish, distal half fuscous brown suffused with whitish, or mostly whitish except brown annulation distally on article 2. Antenna fuscous brown.

Thorax. Dorsal surface olive-brown to fuscous brown, or whitish with light brown suffusion. Collar and tegulae mostly whitish. Ventral surface and legs whitish, sparsely or densely suffused with olive-brown, or with tibiae and tarsi olive to fuscous brown.

Wings. Forewing moderately broadly lanceolate; upper surface whitish with irregular small patches of brown scattered about basal third mostly behing fold, or mostly fuscous to olive-brown with whitish suffusion; cilia drab or brown [in light specimen (male 2), dark cilia constrast with pale wing surface]. Hindwing uniformly drab to fuscous brown with slight metallic iridescent hue; cilia drab or brown, with light metallic purplish hue. Ventral surface of both wings uniformly drab or pale fuscous brown, with slight iridescent hue.

Abdomen (seen undissected only for dark specimen). Dorsal surface drab with marked iridescent hue, distal half lightly suffused with whitish; ventral surface dull whitish lightly suffused with drab; apical tufts ochreous white. Terga and sterna (seen in potash-cleared abdomen) as in *S. ochristriata*.

Male genitalia (Fig. 176). Similar to *S. ochristriata* except as follow: T8 with Y-shaped sclerotization broader and heavier. Tegumen transversely broader, paired processes apically more pointed, dorso-apical margin more slanted; erect setae of dorsal hump darkly pigmented and more numerous; ventral tooth-like pegs 12 or 13 in single irregular row; glandular foveae wider, more conspicuous. Medio-caudal process of juxta larger, lobiform, apically rounded (not creased as in *S. perspicillella*). Valva heavier, distal portion broadened; cucullar lobe broader, more densely setose; apical projection acuminate and more ventrally oriented; ventral margin with additional rounded process anterior to apical projection; margin between cucullus and apical projection roundly protruded; inner surface of valva ventro-medially setose. Aedeagus larger, not apico-laterally emarginate.

Female genitalia unknown.

Variation. — The only adult specimens examined, two male paratypes, differed markedly in color pattern of forewings: one (Fig. 29) has predominantly dark olive-brown forewings whereas the other (Fig. 30) has predominantly whitish forewings. The dark specimen has seven and eight teeth on the tegumen processes, the pale one has 12 and 14. Because color pattern of forewings is varied and number of pegs frequently differs on both tegumen processes of specimens of the closely related *S. ochristriata* , I consider the differences between the two male paratypes of *S. suffusa* to be intraspecific variation, at this time. More abundant material is needed to allow a better assessement of intra- and inter-specific variation in the *S. ochristriata* group.

Phylogenetic relationships. — This species belongs to the same genus as *S. ochristriata* (Walsingham), and *S. perspicillella* (Walsingham) to which it is closely related.

Geographical distribution and period of flight. — Known only from the type locality (Fig. 419) and type series. The type series was collected in August.

Hostplant. — Unknown.

3.3.4 *Scythris altisierrae* Keifer

(Figs. 32, 180-182, 263, 317, 378, 419)

Scythris altisierrae Keifer, 1937: 186.— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist].

Type material examined. — HOLOTYPE male in CAS, labelled: "Ebbett [sic] Pass/ Alpine Co./ Cal. viii-20/ 1936 Keifer"; "Rf Solanum/ xantii/ ix-10-1936"; "TYPE/ Scythris/ altisierrae/ Keifer" [red with narrow black border, printed]; "[male symbol] genitalia on/ slide no./ JFL-85-0277/ by J.F. Landry/ CAS coll." [green, printed with male symbol and number handwritten; this label was affixed by me]; "Collection of the/ California Academy/ of Sciences San/ Francisco, Calif." [white with a red cross-strip, printed]. The abdomen and genitalia have been dissected (probably by Keifer) and remounted by me on slide no. JFL-85-0277. ALLOTYPE female, labelled same as holotype except for emergence date: "ix-8-1936" (CAS). The allotype's abdomen and genitalia were also dissected by (probably)Keifer and were remounted by me on slide no. JFL-85-0278.

PARATYPES: Keifer (*loc. cit.*) designated 17 paratypes; four are in USNM, two are in UCB, and location of the rest is unknown. Two males and two females (USNM) labelled same as holotype except for emergence date: two males and one female "ix-8-1936", one female "ix-18-1936"; data on UCB paratypes unavailable. According to Keifer (*loc. cit.*), all paratypes are labelled 'about' the same as the holotype.

Type locality. — Ebbetts Pass, Alpine Co., California.

Recognition. — Adults are medium-large scythridids with forewings fuscous-brown with a buff-ochreous streak in the fold extended to about the middle of wing and with some white suffusion coalesced into indistinct patches in some specimens (Fig. 32). Adults of a few undescribed species have a somewhat similar color pattern but are distinctly smaller in size. *S. altisierrae* is similar to members of the *S. ochristriata* group in aspect of male genitalia but is readily distinguished from them by its larger body size and enormous valvae (Fig. 181). A closely related, undescribed species occurring in southern California has similarly enlarged male valvae but is readily distinguished by its uniformly drab forewings and smaller body size.

Description. — Size. Forewing length 6.4-6.9 mm; hindwing length 5.4-5.8 mm; wing expanse 14.3-15.1 mm (4 specimens).

Head. Face fuscous-brown to pale brown with light metallic purplish hue; clypeal area buff; area behind antennal sockets and neck tufts dirty white to light buff. Eyes relatively small, distinctly narrower than frons. Haustellum base with whitish scales suffused with fuscous-brown scales. Maxillary palpi as in *S. ochristriata.* Labial palpi whitish, distal half of articles 2 and 3 ventrally annulated with fuscous-brown, in some specimens most of ventral surface of article 3 covered with brown scales; apex extended to level of vertex. Antenna about two-thirds length of forewing, fuscous-brown with slight metallic purplish hue.

Thorax. Dorsal surface medially fuscous-brown with slight iridescent hue, laterally buff or clay-colored; tegulae and lateral portion of collar clay-colored. Ventral surface whitish to very light drab with slight metallic iridescent hue. Legs colored as ventral surface, except tibiae and tarsi predominantly light to fuscous-brown suffused with whitish.

Wings. Forewing elongate-lanceolate; ground color of upper surface olive- to fuscous-brown, dark brown in basal half behind fold, with slight purplish hue more pronounced in distal half (Fig. 32); cubital fold with moderately broad ochreous-buff streak extended from base to about middle of wing, indistinct beyond middle; distal two-thirds with scattered white scales, clustered in intistinct patches in some specimens; cilia brown. Hindwing uniformly fuscous-brown with iridescent hue more pronounced than on forewing; cilia fuscous-brown. Ventral surface of both wings uniformly pale brown with slight iridescent hue.

Abdomen. In males, dorsal surface grey-brown or drab with iridescent hue, ventral surface whitish in proximal third to whitish-ochreous distally. In females, dorsally similarly colored with marked iridescence, ventrally entirely whitish except terminal sternum latero-distally brownish. Anterior margin of T3-T7 (as seen in potash-cleared abdomens) more distinct than in *S. ochristriata.* In males, T7 reduced in extent, somewhat indistinct and Y-shaped as T8; S7 with anterior margin laterally protruded, protrusion extended into membranous fold formed by intersegmental membrane. T8 (Fig. 263) with Y-shaped sclerite relatively heavy, paired anterior arms longer than single medial arm, medial arm apically bent ventrad; medio-apical tuft of hair-like scales much shorter than T8, very dense and compact. S8 as in *S. ochristriata* but thicker. In females, segment 7 about twice as long as preceding segment; T7 elongate rectangular, laterally sinuate; S7 subrectangular, distinctly sclerotized throughout, caudal margin V-emarginate; intersegmental membrane between segments 7 and 8 long, equal to about half length of segment 8. T8 elongate, distally widened and laterally margined with rods extended from point of attachement of anterior apophyses to caudal margin; medial membranous area triangular.

Male genitalia (Fig. 180-182). Similar to those of *S. ochristriata* except as follow: tegumen (Fig. 180) proportionally shorter, lateral portions strikingly convex, antero-dorsal emargination very broad and deep; beak-like processes pointed ventrad and situated very low between valvae base, apices tapered, convergent and subcontiguous; dorsal hump subtuberculiform, prominent; glandular foveae large, conspicuous, sclerotized portion of internal duct broad, conspicuous; ventral margin with 12 or13 tooth-like pegs in single irregular row. Medial portion of juxta invaginated cephalad. Vinculum longer than height of lateral portion of tegumen, markedly bent caudad over base of valvae (which results in uncus arms positioned very low between valvae). Valvae enormous (Figs. 181-182), nearly as long as abdominal segments 2-7 combined, straight, subparallel; cucullus very broad, bent inwardly; distal portion caudad to cucullus subequal in length to rest of valva; apex lobiform, twisted inward and downward; inner wall partly membranous; ventral margin straight.

Female genitalia (Fig. 317). Similar to those of *S. ochristriata* except as follow: sterigma laterally with cluster of few fine setae. Corpus bursae (Fig. 378) elongate, cylindrical. Anterior apophyses moderately thick, parallel, subequal in length to T8. Posterior apophyses twice as long as, and distinctly thinner than anterior ones. Ovipositor slightly longer than T8; abdominal portion from intersegmental membrane between segments 7 and 8 to apex of extended ovipositor equal in length to rest of abdomen. Papillae anales membranous, parallel-sided.

Variation. — Specimens examined vary in extent of white suffusion on the dorsal surface of forewings: paler specimens have dense white suffusion mostly in the distal third of wing and also along the ochreous streak of fold where they form interrupted, irregular streaks. Darker specimens have most of the forewing upper surface dark fuscous-brown with indistinct lighter suffusion due to of dark-tipped scales with a pale base. Variation in structures of genitalia was not examined.

Phylogenetic relationships. — *S. altisierrae* belongs to the same lineage as *S. ochristriata* (Walsingham), *S. perspicillella* (Walsingham) and *S. suffusa* (Walsingham) based on structural similarities in male and female genitalia.

Geographical distribution and period of flight. — Known only from two widely separated localities in California (Fig. 419): the type locality at Ebbetts Pass, and Tejon Pass, Los Angeles Co., California (at an elevation below 4000'). The species is undoubtedly more widespread than is currently known, possibly following the distribution of its hostplant. Adults of the type series emerged in early September from larvae collected in mid-August.

Hostplant. — The type series of adults was reared from larvae feeding in a web on *Solanum xantii* (Solanaceae). Adult specimens from Tejon Pass were also reared from larvae found on plants of that species (J.A. Powell, pers. comm.).

3.3.5 *Scythris limbella* (Fabricius)

(Figs. 1-2, 150, 183-186, 304-305, 372, 403)

Tinea limbella Fabricius, 1775: 660.

Tinea variella Denis & Schiffermüller, 1775: 140.

Tinea quadriguttella Thunberg, 1794: 87.

Tinea tristella Hübner, 1796, plate 32, fig. 218, *nec* Denis & Schiffermüller, 1775: .

Tinea chenopodiella Hübner, [1813], plate 46, fig. 320.

Notes about synonymy. — The synonymy of this Palearctic species has been revised and discussed by Karsholt and Nielsen (1976) and the listing follows theirs. References to citations of the names are not given because they are mostly in publications about the European fauna. The species appears to have been recently introduced on this continent and was not reported in North American publications until 1971. *Tinea chenopodiella* Hübner is the type species of *Scythris* Hübner.

Tinea cylindrella Fabricius, 1777 has been incorrectly attributed to Stephens and listed in the synonymy of *S. chenopodiella* (Hübner) or *S. limbella* (Fabricius) in various combinations [*Astyages cylindrella* Stephens, 1834 ; *Glyphipteryx cylindrella* Stephens, 1834; *Gracillaria cylindrea* Haworth, 1828: 529, an invalid emendation of *G. cylindrella* (Fabricius)]. *Tinea cylindrella* Fabricius, 1777 is actually a junior synonym of *Stathmopoda pedella* (Linneaus, 1761) and should not be associated with *Scythris limbella* (Fabricius) (O. Karsholt, ZMUC, pers. comm., 1986).

Type material. — No type material was examined for any of the nominal species listed here. However I have seen color plates of *Tinea chenopodiella* Hübner and *Tinea tristella* Hübner from the author's 1796 and 1813 works. The lectotype of *Tinea limbella* Fabricius is in ZMUC and was designated by Karsholt and Nielsen (1976).

Recognition. — Adults are medium-sized scythridids with mostly grey-brown or olive-brown upper surface and forewings with various irregular cream-color markings (Figs. 1-2). No adults of other known Nearctic species exhibit a similar color pattern of forewings. Features of male and female genitalia also distinguish adults of *S. limbella* from those of all other Nearctic scythridids: in males (Figs. 185-186), gnathos scythe-like and asymmetrical, valvae sigmoid, ventrally twisted, S8 (Figs. 183-184) caudally furcate; in females, sterigma tongue-like, basally constricted and medial on S8 (Fig. 305), and bursa anteriorly U-bent (Fig. 312). Overall aspect of the male genitalia is somewhat similar to that of *S. immaculatella* ; differences are discussed under that species.

Description. — Based on North American specimens. Size. Forewing length 6.1-7.3 mm (mean = 6.8); hindwing length 5.4-6.4 mm (mean = 6.0); wing expanse 13.5-16.2 (mean = 15.1) (15 specimens).

Head. Face olive-brown, cream-color or olive-brown suffused with cream-color, with metallic lustre; neck tufts cream-color. Eye relatively large, almost as wide as frons. Haustellum almost as long as body, base with cream-color, or olive-brown suffused with cream-color, scales. Maxillary palpi conspicuous, folded over base of haustellum. Labial palpi extended to level of scape, in light specimens cream-color with light olive-brown suffusion on articles 2 and 3 and metallic lustre; in dark specimens articles 2 and 3 mostly olive-brown with scattered cream-color suffusion and metallic lustre. Antenna extended to about two-thirds of forewing length, filiform, distinctly ciliate in males, with very fine, indistinct cilia in females; olive-brown with metallic lustre.

Thorax. Dorsal surface with metallic lustre; in pale specimens mostly cream-color; in darker specimens medially drab or olive-brown and laterally cream-color, or entirely olive-brown; in specimens with bicolored surface, tegulae basally olive-brown, distally cream-color. Ventral surface in pale specimens cream-color, in dark specimens drab. Legs in pale specimens basally and inwardly cream-color, distally and outwardly drab or olive-brown; in dark specimens inner side whitish or drab, outer side olive-brown.

Wings. Frenum present. Forewing elongate-lanceolate, apex acute, termen sinuate; upper surface with pale golden metallic lustre, in pale specimens with ground color drab scatteringly suffused with cream-color and ochreous, with broad cream-color streak extended from base to apex of fold and interrupted by two or three irregular olive-brown spots or blotches in basal half, the larges spot extended from fold to hind margin; in intermediately colored specimens (Fig. 1), ground color olive-brown or dark grey mixed with some brown on disc, with cream-color markings as follows: streak extended in fold from base to about middle of wing, basal third with oblique streak from plical streak to hind margin, distal third near termen with large blotch, in many specimens streak extended to distal blotch; in darkest specimens (Fig. 2), surface mostly olive-brown with two medial cream-color dashes, distal blotch near termen and very sparse suffusion behind fold; ventral surface drab, brown, dark grey or olive-brown, in pale specimens with costa in distal ~~half~~ cream-color; cilia drab or olive-brown. Hindwing elongate-lanceolate, apex pointed, termen indistinctly sinuate; female frenulum with three bristles; basal half with area between cubitus and anals on both surfaces unscaled or very scatteringly scaled; upper surface pale or dark brown, or drak grey, with purplish and greenish metallic hue; ventral surface drab, brownish or olive-brown; cilia drab or olive-brown.

Venation (Fig. 150). Forewing with 12 veins; Sc ended at about middle of costa; R1 origin slightly beyond middle of Rs; R4 and R5 stalked, R4 extended to costa, R5 to termen; M3 and CuA1 connate, obsolete in some specimens; CuP developed at margin, slightly shorter than CuA2; 1A+2A forked basally, 1A somewhat obsolete but distinct. Hindwing with 8 veins; Sc+R1 subparallel to Rs, extended to two-third of costa; Rs and M1 separate, subparallel; M2+M3 stalked; CuP obsolete (? or absent); 1A+2A forked basally, unmelanized but distinctly elevated.

Abdomen. In males, upper surface grey, drab or olive-brown with metallic greenish and purplish hue, caudal margin of terga slightly paler; ventral surface whitish, or brownish suffused with whitish; terga indistinctly sclerotized, anteriorly thinly margined; T8 unmodified, subquadrate, anteriorly with broad, round emargination; sterna unmargined, S2 irregularly sclerotized, S3-S7 distinctly sclerotized; S8 (Figs. 183-184) most sclerotized, modified, convex, subttriangular, medio-caudally with broad, apically furcate projection, anteriorly roundly emarginate, laterally extended dorsad around sides of genitalia. In females, upper surface brown or dark brown with iridescent hue, caudal margin of terga cream-color or yellowish, in some specimens anterior margin of T7 also yellowish; ventral surface mostly whitish, base and sides drab in most specimens, S7 apically yellow and, in some specimens, medially with drab suffusion; terga moderately sclerotized, T2-T4 anteriorly margined; T7 most sclerotized, transversely broadly rectangular; sterna unmargined, S2-S3 with small latero-caudal fenestra, S1-S5 lightly sclerotized, S6-S7 most sclerotized; S6 medio-anteriorly with deep, oval emargination; S7 (Fig. 304) elongate-trapezoid, medio-caudally with U-shaped or V-shaped emargination.

Male genitalia (Figs. 185-186). Symmetrical. Tegumen in dorsal aspect (Fig. 186) caudally slightly narrowed, caudal margin heavily sclerotized, with shallow V-emargination, anterior margin with deep V-emargination about half length of tegumen; in lateral aspect (Fig. 185) antero-dorsally rounded, sides elongate, ± ellipsoid. Uncus oriented ± ventrad, in dorsal aspect horseshoe-shaped, laterally setose, with paired small antero-dorsal teeth. Gnathos relatively heavy, scythe-like in lateral aspect, asymmetrical in caudal aspect with distal hooked portion on left side. Vinculum extended caudad beneath valvae to about half length of valvae; in ventral aspect somewhat U-shaped with apex of U arms articulated to pedunculi. Valvae caudally tapered, markedly sigmoid, distal half twisted ventrad; inner side with scattered fine setae; base articulated. Juxta about two-thirds length of aedeagus, as narrow, flattened rod with more sclerotized Y-shaped area, curved caudad, fused to base of aedeagus, ventrally articulated between contiguous base of valvae. Aedeagus tubular, straight, about half length of valvae, base flat, bent ventrad, ankylosed to juxta, apical portion slightly tapered and downcurved. Bulbus ejaculatorius small, subcrescentic.

Female genitalia. T8 subquadrate, slightly sclerotized, medio-caudally membranous. S8 indistinctly sclerotized or membranous. Sterigma (Fig. 305) medial on S8, linguiform, baso-laterally constricted, ventrally flat; distal half off plane of S8 and laterally more sclerotized, bilobate in ventral aspect. Ostium very small, at apex of sterigma, pointed caudad. Ductus bursae membranous, inception ventral near anterior end of bursa. Corpus bursae (Fig. 372) oblong, medially or distally bulged, anterior third U-bent to left side; caudal portion abruptly narrowed into ductus seminalis. Spermatheca (Fig. 372) somewhat bean-shaped, distal end narrow, sigmoid; ductus spermatheca not coiled. Anterior apophyses straight, slightly divergent, about twice length of T8. Posterior apophyses thinner and about 1.5 x length of anterior ones. Ovipositor short, about 0.25x length of T1-T7; papillae anales membranous.

Variation. — Palest specimens have the head, dorsal surface of thorax and most of the forewing upper surface credam-color, the olive-brown markings of forewings being restricted to the costal and apical areas and to a few irregular, short dashes or streaks on disc. Most specimens examined are intermediately colored (Fig. 1) with a mixture of olive-brown and cream-color on the head and dorsal surface of thorax, and the forewings predominantly olive-brown or grey with cream-color markings on proximal three-quarters between fold and hind margin. In a few darkest specimens (Fig. 2), the head and upper surface of thorax and forewings are almost completely dark olive-brown, with cream-color markings of forewings reduced to two or three spots or short streaks on disc. Coloration of the latter approaches that of the so-called form *obscura* mentioned and illustrated in Bengtsson (1984). Variation in genitalia was not examined.

Phylogenetic relationships. — Related to the Palearctic *S. limbelloides* Jäckh, 1977 (Jäckh 1977b) based on the probably apomorphic feature of down-twisted valvae. This species group along with several other Palearctic species (for example *S. obscurella* (Scopoli), *S. cicadella* (Zeller), *S. bifissella* (Hofmann) and their close relatives), the Nearctic *S. mixaula* Meyrick, *S. trivinctella* (Zeller), and their relatives possibly encompass the genus *Scythris* in a restricted sense based on common possession, in males, of a characteristically triangular or subtriangular sternum 8 extended beneath the genitalia and caudally produced into a bifurcate projection, and horseshoe-shaped or U-shaped uncus.

Geographical distribution and period of flight. — Distributed over most of Europe, north to northern Scandinavia, east to central Asia (Bengtsson 1984). Recently introduced in northeastern North America (Sheppard 1970, 1974). Earliest known records were collected in 1957 in Ithaca, New York (USNM). Now known to occur in southwestern Québec (earliest record 1964, CNC, LEM), Connecticut (1967, USNM), New York, Indiana (1967, USNM), Illinois (1967, USNM, INHS) and Massachusetts (1971, USNM) (Fig. 403).

Hostplants. — *Chenopodium sp.* and *Atriplex sp.* (both Chenopodiaceae) (Spuler 1910: 440, Meyrick 1928: 725, Lhomme 1949: 803, Bengtsson 1984: 41). The species has recently been reared on *Atriplex sp.* in New York state (J.G. Franclemont, pers. comm. 1984) and from *Chenopodium sp.* in Illinois (S. Passoa, pers. comm. 1986).

3.3.6 *Scythris immaculatella* (Chambers), status re-established

(Figs. 7, 135, 192-193, 310-311, 373, 403)

Butalis immaculatella Chambers, 1875: 10.— Chambers, 1878a: 93 [note about variation] and 1878c, p. 133 [referenced list].— Walsingham, 1888: 114 [suggested synonymy with *B. impositella* Zeller].— Smith, 1891: 107 [checklist, as a synonym of *B. impositella* Zeller].

Scythris immaculatella ; Dyar, 1902: 538 [catalogue].— Barnes and McDunnough, 1917: 190 [checklist].— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist] [as a synonym of *S. impositella* (Zeller) in all citations].

Scythris pacifica McDunnough, 1927: 275.— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist]. **New synonymy.**

Notes about synonymy. — The name *S. immaculatella* has long been considered a synonym of *S. impositella* (Zeller) but examination of the genitalia of the female type shows that the species is distinct: in *S. immaculatella*, the bursa copulatrix is a single sac and the sterigma is a plate with a medial invagination situated on sternum 8; in *S. impositella*, the bursa is a sac with an accessory bulla and the sterigma is a conical projection situated between sterna 7 and 8.

Type material examined. — ***Butalis immaculatella*** : HOLOTYPE female in MCZ, labelled: "Type/ 1515" [top white, rest red]; "Tex." [white, printed]; "Chambers" [white, printed]; "46" [white, handwritten]; "immaculatella/ Chb." [white, handwritten]; "[female symbol] genitalia on/ slide no./ JFL-85-0291/ by J.F. Landry/ MCZ coll." [green, partly printed, partly handwritten, added by me]; "MCZ" [orange, typed, added by me].

Scythris pacifica : HOLOTYPE male in CNC (CNC type no. 2657), labelled: "Seton Lake/ Lillooet, B.C./ 15-vi 1926/ J. McDunnough"; "HoloTYPE/ Scythris/ pacifica McD/ No. 2657" [red, partly handwritten, partly printed]; "SLIDE/ No. S.I." [green, partly printed, partly handwritten]; "Return to/ C.N.C." [red, printed]. The specimen was dissected by (apparently) McDunnough and the genitalia are on a slide with two labels; the first label is McDunnough's original: "Lab. No S.I./ Scythris/ pacifica/ McD/ Date BC/ Entomological/ Branch/ Ottawa, Canada/ Type" [white, partly printed, partly handwritten]. The second label was added by me: "Can. Nat. Coll./ Type No. 2657/ Scythris/ pacifica/ McDunnough/ HOLOTYPE [male symbol]/ Slide No. S.I." [red, partly printed, partly handwritten]. The abdomen is missing and only the genitalia, including sternum 8, are on the slide. ALLOTYPE female labelled same as holotype, except for collecting date, which is "28-v-1926" (CNC); abdomen and genitalia dissected and on slide no. JFL-85-0345. PARATYPES, five males: and three males labelled same as holotype, except for collecting dates "27-v-1926" (one male, UCB), "28-v-1926" (one male, CNC), "4-vi-26 (one male, CNC); one male: "Waterton Lakes/ Alta./ 12.vii.1923/ J. McDunnough", "PARATYPE/ Scythris/ pacifica/ McD/ No. 2657" [yellow, partly printed, partly handwritten]; another male labelled as preceding except for date, "20.vii.1923" (both in CNC).

Type localities. — ***Butalis immaculatella*** : Bosque Co., Texas.
Scythris pacifica : Seton Lake, near Lilloet, British Columbia.

Recognition. — Adults are medium-sized scythridids with almost entirely unicolorous grey or dark grey body with a light gloss and upper surface of forewings somewhat darkened by olive-brown suffusion (Fig. 7). They resemble those of the closely related European *S. paullella* but the latter are of a paler grey without brownish suffusion on the forewings. At least one undescribed species (related to *S. ochristriata*) is of a somewhat similar size and appearance but its ground color is distinctly brown instead of grey. As far as known, *S. immaculatella* is the only Nearctic species whose adults have porrect or slightly drooped labial palpi; adults of all other species have upcurved labial palpi. Male and female genitalia also distinguish it from all other Nearctic species: in males, S8 (Figs. 192-193) is very convex with a long, upwardly bent, apically furcate projection, the uncus (Fig. 193) is U-shaped, the gnathos is thorn-like, the vinculum projects caudally with its distal half sigmoid and the valvae are free with a broad, spatulate distal half; in females, the (Fig. 311) sterigma is a relatively small, oval and concave plate at the caudal margin of S8. The genitalia resemble very closely those of *S. paullella* ; they are somewhat similar to those of *S. limbella* among Nearctic species but in the latter, the projection of T8 is short with a wide furcation, the gnathos is a heavy asymmetrical hook and the valvae are not distally spatulate (Figs. 183-186).

Description. — Size. Forewing length 5.3-6.5 mm (mean = 5.9); hindwing length 4.2-5.5 mm (mean = 5.0); wing expanse 11.7-14.2 mm (mean = 13.0) (12 specimens).

Head. Face and neck tufts grey-brown in most specimens, olive-brown or fuscous brown in few specimens, with light brassy lustre and light purplish or greenish hue. Eyes narrower than frons. Haustellum covered with pale grey scales. Maxillary palpi very small and short, inconspicuous, not extended over base of haustellum. Labial palpi relatively short, in most specimens porrect, in some specimens drooped, in few specimens with last article slightly upcurved and extended to level of antennal scape; in most specimens grey or olive-brown, in some specimens olive-brown with article 1 pale grey. Antenna extended to about two-thirds length of forewing, colored as face, ventrally densely ciliate.

Thorax. Dorsal surface colored as head, ventral surface slightly paler. Legs grey or pale grey with light brassy lustre and greenish hue.

Wings. Frenum present. Forewing broadly elongate-lanceolate, apex pointed, termen indistinctly sinuate; upper surface with ground color in most specimens grey or drab, area behind radius densely suffused with olive-brown or rufous brown, with brassy lustre and greenish hue; in some specimens entire surface with scattered olive-brown suffusion; ventral surface drab or grey with same lustre and hue as upper surface; cilia grey or drab. Hindwing elongate-lanceolate, apex pointed, termen almost straight; female frenulum with two bristles; upper surface drab or light olive-brown with same lustre and hue as forewing upper surface; ventral surface colored as that of forewing; cilia grey or drab. Venation (Fig. 151) as in *S. limbella* except as follow: hindwing with M2 and M3 connate and forked with CuA1, CuP absent.

Abdomen. Entirely pale grey with light metallic lustre and greenish hue; in some male specimens, dorsal surface brownish grey. In males, T2-T7 (as seen in potash-cleared specimens) very lightly or indistinctly sclerotized, anteriorly thinly margined; T8 distinctly sclerotized, unmargined, rectangular, unmodified; S2-S3 lightly sclerotized, S5-S7 more sclerotized, anteriorly thinly margined; S8 (Figs. 192-193) markedly sclerotized, enlarged, modified, extended beneath and caudad of genitalia: markedly convex with uneven surface, anteriorly broadly V-emarginate, laterally extended dordad around lateral portion of genitalia, latero-dordal margin notched and with short transverse inner carina, caudal margin medially produced into long, heavy projection markedly bent dorsad at right angle and apically forked. In females, T2-T6 indistinctly sclerotized, anteriorly margined; T7 markedly sclerotized, broadly subquadrate, lateral margins caudally curved, caudal margin with broad, rounded emargination; sterna unmargined; S2-S6 lightly sclerotized, S7 (Fig. 310) markedly sclerotized, transversely rectangular, slightly convex, caudal margin medially with narrow, shallow, rounded emargination.

Male genitalia (Fig. 193). Symmetrical. Tegumen elongate, dorsally flat; sides bent inwardly, tegumen thus partly closed ventrally; in dorsal aspect, anterior margin with deep V-shaped emargination about two-third length of tegumen, sides basally bulged, distally constricted, apex bilobate. Uncus in dorsal aspect U-shaped or V-shaped; in lateral aspect each arm with medio-ventral blunt tooth, apex broad and tapered or thin and acuminate, in some specimens slightly upcurved. Gnathos relatively thick, thorn-like, pointed ventrad, base caudally slightly protruded, apex extended slightly below apex of aedeagus. Vinculum large, markedly convex, extended caudad beneath valvae to about half length of valvae; antero-ventral margin U-emarginate, distal half tongue-shaped, sigmoid in lateral aspect, medio-longitudinally carinate, dorso-medially with raised flap produced between base of valvae; lateral portions broad, rounded, elevated. Valvae moderately incurved, broadly spatulate with concave side turned ventrad; in lateral aspect costa medially elevated into pointed, setose protuberance; base articulated, not fused. Juxta elongate, rudder-like, vertical, fused to base of aedeagus, ventrally articulated between contiguous base of valvae. Aedeagus tubular, thin, straight, almost as long as valvae; base flat, bent ventrad, ankylosed to juxta; apical portion tapered, slightly downcurved. Bulbus ejaculatorius undeveloped.

Female genitalia. T8 anteriorly and laterally lightly sclerotized, U-shaped, medial area membranous. S8 indistinctly sclerotized laterally, slightly sclerotized medially, longitudinally striulate. Sterigma (Fig. 311) as oval, concave plate situated at caudad margin of S8. Ostium at anterior end of sterigma, slightly recessed, small. Ductus bursae membranous, inception laterally in distal half of bursa. Corpus bursae (Fig. 373) oblong, slightly curved, wider anteriorly, caudally abruptly narrowed into ductus seminalis. Spermatheca ovoid, ductus not coiled. Anterior apophyses straight, slightly divergent, about 1.5x length of T8. Posterior apophyses distinctly thinner than, and about 1.5x length of anterior ones. Ovipositor relatively short, one third length of T1-T7, distal portion markedly tapered.

Variation. — Most specimens examined are grey or dark grey with olive-brown suffusion on most of upper surface of forewings. One male examined from Texas had the dorsal surface of body fuscous brown with no trace of grey. In male genitalia, the uncus varies in dorsal aspect from U-shaped to V-shaped, in lateral aspect the arms of the U vary from broad and rounded to narrow and pointed. The pointed portion of the gnathos varies from slightly curved cephalad to straight and slightly bent caudad. Variation in female genitalia was not examined.

Phylogenetic relationships. — Closely related to the European *S. paullella* , which is probably its sister species. However it cannot at present be ruled out that the two taxa are conspecific. Although there are several small differences, mostly in male and female genitalia, these consist mostly of slight differences in proportions and shape of structures which may be clinal or somehow geographically related. North American records are still too few and scattered to permit detailed study of variation.

Geographical distribution and period of flight. — Known from central Alaska, southern British Columbia, southwestern Alberta, northwestern Montana and Wyoming, southern Colorado, central Texas, Kentucky and North Carolina (Fig. 403). The Alaskan record suggests that the species might also occur in eastern Siberia. A continuous distribution across Beringia, Siberia and west to Europe would support that *S. immaculatella* is conspecific with *S. paullella* . With the Texas record excepted, the distribution suggests a boreo-montane species. The type locality of *S. immaculatella* in Texas is in an area of moderately elevated (< 2000 ft.) plains in the grassland-oak forest transition zone. Adults have been collected from mid-May to late June on the coast and the interior of southern British Columbia, in mid- to late June in the southern Rocky Mountains and mid- or late July in the northern Rockies, late June in Alaska, and early to mid-June in eastern United States.

Hostplant.— Unknown. The reported hosplant for the closely related *S. paullella* is a moss *Polytrichum sp*. (Schütze 1897) which appears doubtful. Schütze (1897) reported that while looking for larvae of *S. paullella* he discovered on *Polytrichum* moss larvae in webs which later emerged as adults of *Bryotropha* (Gelechiidae) and *Penthina* (Tortricidae).

3.3.7 *Scythris mixaula* Meyrick

(Figs. 3-6, 156, 177-178, 187-190, 306-309, 374, 410)

Scythris mixaula Meyrick, 1916: 14.— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist].

Type material examined. — Most of type material in BMNH and not examined. LECTOTYPE male designated by Clarke, 1965: 578. For notes about type material, see Clarke, *loc. cit.*

PARALECTOTYPE examined, one male (USNM), labelled as follow: "Colorado/ R. .07" [in Meyrick's handwriting]; "Comp. with type./ Scythris/ mixaula/ Meyrick/ Det. J.F.G.C. 1948" [Clarke's label]; "Scythris/ mixaula/ [4/3] Meyr./ E. Meyrick det./ in Meyrick Coll." [Meyrick's label]; "Meyrick Coll./ B.M. 1938-290." [printed, upside down]; "[male symbol] genitalia on/ slide no./ JFL-83-1039/ by J.F. Landry/ in USNM coll." [green, partly printed, partly handwritten, added by me]; "Return to/ U.S. Nat. Mus." [yellow, printed, added by me]. This specimen corresponds to the material listed by Meyrick in his original description and is part of the type series.

Recognition. — Adults are slender, medium-large to large scythridids with the upper surface of forewings in dark specimens greyish or brownish with fine, diffuse white lines over veins (Fig. 3) or, in pale specimens mostly white with diffuse brownish-ochreous streaks between veins (Figs. 4-5). In external appearance adults of *S. mixaula* resemble those of a closely related, undescribed species occurring in southern California. They are best distinguished from the latter by features of the male genitalia: in *S. mixaula*, S8 (Figs. 177-178) is broad, with markedly elevated, vertical, sclerotized sides and apical furcation almost as long as the sternum, the valvae (Fig. 187) are basally downcurved with the ventral margin arched, have the outer side of the base flat, the costa without, or with a small, inner tooth, and the dorsal margin apically angulate. In the closely related, undescribed species, S8 is narrowly elongate, laterally membranous, has the apical furcation thin and shorter than the sternum, the valvae are straight with the dorsal margin apically rounded, the outer side of the base dilated, and the costa with a large, apically hooked inner process. Aspect of the male genitalia also distinguish adults of these two species from those of all other Nearctic species. In female genitalia, *S. mixaula* is distinguished by the lack of sterigma and of sclerotization on S8 and around the ostium (Fig. 307-308), the asymmetrically looped spermatheca and the bulbous, almost spherical bursa (Fig. 374). Palest adults of *S. mixaula* (Fig. 6) much resemble in external appearance and size those of some species of the *Arotrura* complex of genera (Fig. 51). They can be readily distinguished from the latter in the males by the developed S8, and in the females by the trisetose frenulum and the postero-medially emarginate S7 (Fig. 309) [members of the *Arotrura* complex possess in the males a very reduced S8 , and in the females a bisetose frenulum and postero-medially lobate S7 (Fig. 362)].

Description. — Size. Forewing length 6.0-9.4 mm (mean = 8.1); hindwing length 5.5-8.2 mm (mean= 6.9); wing expanse 13.5-20.3 mm (mean = 17.6)(15 specimens).

Head. Face and neck tufts white, or white mixed with pale drab or pale ochreous on vertex. Eye in most specimens very large, globulous, as wide as, or slightly wider than frons, in few females globulous but smaller, distinctly narrower than frons. Haustellum very short, as long as, or shorter than labial palpii, extreme base with few white scales; pilifers prominent. Maxillary palpi conspicuous, four-articled, folded over base of haustellum. Labial palpi upcurved, extended to, or almost to level of vertex; white except ventral side of article 2 mostly drab, ochreous or pale olive-brown, and article 3 with some similarly colored suffusion. Antenna thin, filiform, extended to two-thirds of forewing length, grey-brown or drab, scape, pedicel and few proximal antennomeres with some white; scape compressed, antero-ventrally with dense, long pecten or 30-40 hairlike-scales; flagellum in males with dense, long cilia, in females with few short cilia.

Thorax. Dorsal surface in dark specimens white mixed with drab or brownish, in pale specimens entirely white or mostly white mixed with some pale ochreous. Ventral surface in dark specimens pale drab, in pale specimens white. Legs: in dark specimens fore- and midleg predominantly drab or greyish mixed with some white, trochanter mostly white, hindleg mostly white, tibia with outer side drab, tarsus ventrally with some ochreous; in pale specimens legs almost entirely white, tarsi ventrally ochreous.

Wings. Frenum present (Fig. 156). Forewing very elongate-lanceolate, apex acute, termen slightly sinuate; upper surface in dark specimens (Fig. 3) with ground color drab or grey overlaid with white somewhat forming diffuse lines over veins; in some dark specimens white suffusion dense and covering most of ground color; in few specimens basal third with diffuse oblique white fascia from hind margin to cell; in pale specimens (Figs. 4-6) ground color white, space between veins diffusely brownish-ochreous, in many specimens with brownish or pale olive-brown pre-apical dot and medial oblique, similarly colored, diffuse fascia; ventral surface in dark specimens grey or drab, in pale specimens very pale ochreous or whitish; cilia in dark specimens drab mixed with some white, in pale specimens white. Hindwing narrowly elongate-lanceolate, apex acute, hind margin almost straight; dorsal surface in dark specimens pale grey, in pale specimens white or very pale ochreous; ventral surface colored as upper surface; cilia in dark specimens pale ochreous, in pale specimens very pale yellow or whitish. Venation (Fig. 156) as in *S. limbella* except as follow: forewing with Sc to costa before middle; hindwing with Sc+R1 interrupted or very obsolete veyond middle, M2 and M3 separate; female frenulum with three bristles.

Abdomen entirely greyish-white or pale ochreous-white. In males, T1-T7 membranous and unmargined, or very indistinctly sclerotized and finely margined. S1-S7 moderately or markedly sclerotized, unmargined. In females terga and sterna 1-6 slightly sclerotized, T3-T4 finely margined, others unmargined; T7 (Fig. 306) moderately sclerotized, ± transversely quadrate, antero-lateral angle prolonged into long, oblique rod extended almost to corresponding angle of sternum; S7 (Fig. 309) elongate-trapezoid, well sclerotized, caudal margin with narrow, relatively deep medial U-emargination.

Male genitalia (Figs. 177-178, 187-190). Symmetrical. T8 (Fig. 190) well sclerotized, narrowly elongate, anteriorly emarginate or sinuate, caudal margin deeply indented, indentation extended to almost half length of tergum. S8 (Figs. 177-178) markedly sclerotized, roughly shaped as in *S. limbella* except lateral margin anteriorly with broad, round enamrgination, apical furcation very long and prominent, arms of furcation rod-like, almost as long as sternum, with apex subclavate and, in many specimens, translucent. Tegumen (Fig. 188) in dorsal aspect conical, distally narrowed, with deep anterior V-emargination extended almost two-third length of tegumen. Uncus (Fig. 188) ± bidigitate, processes parallel, projected caudad, ventrally with scattered setae. Gnathos (Figs. 187-189) spear-shaped, with points incurved and downcurved. Vinculum (Fig. 187) reduced, extended caudad, shorter than tegumen, medio-dorsally convex, in ventral aspect ± triangular, antero-lateral angles protruded. Valvae (Figs. 187-188) basally fused to vinculum; base narrow, slightly to moderately downcurved; distal portion dilated, rudder-like in lateral aspect, with inner wall densely setose, dorsal margin apically angulate, ventral margin arched; in some specimens costa basally with small, blunt, inner tooth. Juxta as small, cone-like plate attached ventro-basally to aedeagus and articulated medially on vinculum. Aedeagus (Figs. 187-188) basally ankylosed, about two-third length of valvae, elongate, tubular, upcurved, apex hooked; bulbous ejaculatorius small, crescentic.

Female genitalia. T8 medially indistinctly sclerotized, anterior margin and lateral portions distinctly sclerotized, posterior angles with few fine setae. S8 (Fig. 307) membranous, latero-posteriorly with cluster of few setae. Sterigma undeveloped. Ostium (Fig. 308) medially on caudal margin of S8; membrane around ostium with surface wrinkled, inwardly folded with two small digitate lobes. Ductus bursae membranous, inception ventrally on caudal end of bursa, proximate to ductus seminalis. Corpus bursae374) globulous, subspherical, ductus seminalis caudad, narrow. Spermatheca with two irregular, uneven loops bent in opposite direction of each other. Anterior apophyses divergent, extremely short, about half length of T8. Posterior apophyses thin, more than four times length of anterior ones. Ovipositor very short, about 0.15x length of T1-T7; papillae anales membranous, with coarse surface.

Variation. — Adults of *S. mixaula* are greatly varied in coloration and pattern of forewings (Figs. 3-6), and specimens representing the extremes of these features can be recognized as conspecific only by comparison of their genitalia. In dark specimens, (Fig. 3) the ground color of upper surface of forewings is greyish or brownish with fine, diffuse white lines more or less highliting the veins. In some intermediately colored specimens (Figs. 4-5), the ground color is white, suffused with brownish and with diffuse pale brownish-ochreous streaks between the veins. Several such specimens have a short, oblique brownish streak in the basal third behind the cell (in some specimens this darker streak is anteriorly lined with a white streak) and a small pre-apical brownish spot. In pale specimens, the forewings upper surface is white with very scattered pale ochreous or pale brownish suffusion. Palest specimens (Fig. 6) are almost all ivory white with three or four indistinct, short brownish streaks on disc, and some specimens have pure ivory-white forewings.

Several of the females examined have the eyes proportionally smaller than those of males in being distinctly narrower than the frons. I have not seen so noticeable sex-related variation in eye size in other North American scythridids. Study of more material and species however may show otherwise since intra-specific sex-related differences in eye size are known in ethmiine gelechioids (Powell 1973: 8).

In the male genitalia of most specimens, the base of costa of valvae is unarmed; in few specimens, the costa bears a small, inwardly protruded blunt tooth. The base of valvae varies from slightly to markedly downcurved, and the apical portion of the dorsal margin varies from angulate in most specimens to almost rounded in few specimens.

Phylogenetic relationships. — *S. mixaula* is related to the *S. limbella* group based on the apomorphic structure of sternum 8 of males, which is greatly enlarged and apically furcate. The closest relative and probable sister species is an undescribed species occurring sympatrically in southern California.

Geographical distribution and period of flight. — Known to range from southern California to southwestern Texas and western part of the Great Plains, north to Montana (Fig. 410). Apparent gaps in distribution undoubtedly reflect lack of collecting. Known hostplants (see below) suggest a wider distribution in arid grasslands and deserts at middle and low elevations.

Hostplant. — Four specimens from Kingman, Mohave Co., Arizona (USNM), have been reared from undetermined cactus. Another specimen from Chugwater, Platte Co., Wyoming (USNM), has been reared from prickly pear cactus (*Opuntia sp.*).

3.3.8 *Scythris trivinctella* (Zeller)

(Figs. 9-14, 152, 194-198, 312-313, 375, 404)

Butalis trivinctella Zeller, 1873: 92.— Chambers, 1878a: 93 [notes about variation and similarities with other species of *Butalis*] and1878c, p. 134 [referenced list].— Walsingham, 1888: 114 [notes about variation].— Smith, 1891: 107 [checklist].

Scythris trivinctella ; Dyar, 1902: 538 [catalogue].— Smith, 1903:, p. 117 [checklist].— Barnes and McDunnough, 1917: 190 [checklist].— Meyrick, 1928: 412 [note about color variation].— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist].

Type material. — Type material in BMNH and not examined. I examined a photograph of the type which appears to be a male.

Type locality. — Texas, as given by Zeller.

Recognition. — Adults are medium or medium-small scythridids with ground-color of upper surface of forewings olive-brown or drab and, in most specimens, with three characteristic white or whitish fasciae as follow: a small, basal fascia at the very base along the anal margin, a more elongate, transverse one at one-third, and a another transverse one at about two-thirds (Figs. 9-11). Both medial and distal fasciae are extended from costa to hind margin; the medial fascia is outwardly oblique toward hind margin, whereas the distal one is inwardly oblique toward the hind margin. The distal fascia is broader toward the hind margin and appears shortly bifurcate in many specimens. The white, trifasciate pattern over darker ground-color separates adults of *S. trivinctella* from those of all other Nearctic scythridids except *S. ypsilon* and two other closely related, undescribed species from California and Nevada. Over most of its range however, *S. trivinctella* is the only species with such a color pattern.

In external aspect, adults of *S. trivinctella* are very similar to those of the two related, undescribed species but are distinguished from those of *S. ypsilon* by their forewings of a darker, predominantly olive-brown ground color with moderate or faint metallic lustre and with an additional pale spot in the apical portion. Males of *S. trivinctella* are also distinguished by the caudal, apically indented projection of tergum 8 (Fig. 197), the spiniform projection of sternum 8 (Fig. 198), the paired dorsal projections of uncus, the horseshoe base of gnathos with paired dorsal teeth, the dorsally humped aedeagus (Figs. 194-195). Females are distinguished from those of *S. ypsilon* by the lack of transverse invagination on tergum 7, the transverse sclerotized band of sternum 8, and marked, deep, transverse wrinkles of the membranous portion of sternum 8 (Fig. 313).

Description. — Size. Forewing length 4.3-6.1 mm (mean = 5.4); hindwing length 3.6-5.5 mm (mean= 4.9); wing expanse 9.5-13.5 mm (mean = 12.1)(10 specimens).

Head. Face pale drab, drab, pale olive-brown or olive-brown, with faint golden or reddish metallic hue, clypeal area paler, ± cream-color; neck tufts basally whitish, distally colored as face. Eye medium, rounded or globulous, about as wide as, or slightly narrower than, face. Haustellum base with whitish or cream-color scales. Maxillary palpi conspicuous, folded over base of haustellum, whitish. Labial palpi upcurved, extended to base of antenna in some specimens, or to vertex in most specimens; article 1 white, articles 2 and 3 ± uniformly colored as face, or with inner side mostly white and outer side colored as face. Antenna extended to about two-thirds of forewing, filiform, uniformly olive-brown with moderate golden, reddish or purplish metallic hue, except ventral side of scape white; scape in basal half with sparse pecten of 6-10 piliform scales; ventral side of flagellum densely ciliate in males, moderately so in females.

Thorax. Dorsal surface pale drab, drab or olive-brown, with moderate golden or purplish metallic hue, apical portion of tegulae and distal half of mesoscutellum whitish or white. Ventral surface mostly white or whitish, area below tegula pale drab or drab. Legs with outer side pale drab, drab or pale olive-brown variously mixed with some whitish, inner side mostly white or whitish, with some pale yellow.

Wings. Frenum present (Fig. 152). Forewing elongate-lanceolate, apex subacute, termen slightly sinuate; upper surface with ground color in most specimens olive-brown, in few specimens drab, with moderate or faint golden or reddish metallic lustre, in most specimens apical area with moderate or marked purplish hue; in most specimens (Figs. 9-12) with three white or whitish, obliquely transverse fasciae as follows: basal one extended along anal margin, medial one at one-third extended from costa outwardly to hind margin, and distal one at two-thirds extended from costa inwardly to hind margin and ± shortly bifurcate near hind margin; in some specimens (Fig. 13), basal and medial fasciae joined by longitudinal white fascia in fold; in some specimens basal and medial fasciae joined as single, elongate, plical fascia, in few such specimens, fasciae indistinct; in some specimens ground color almost tan with disc area between white fasciae contrastingly dark olive-brown; ventral surface in most specimens grey or pale drab-brown with distal portion of costa ochreous or whitish, in few females surface dark olive-brown with iridescent hue; cilia olive-brown or drab, with golden and purplish hue. Hindwing narrowly elongate-lanceolate, apex acute, termen indistinctly sinuate; upper surface in most specimens drab or olive-brown, in few specimens dark brown, with moderate or faint purplish or greenish hue; ventral surface with ground color as that of forewing, in males uniformly so, in females with medial and cubital veins lined with pale ochreous or cream-color scales; cilia colored as those of forewing. Venation (Fig. 152) as in *S. limbella* except as follow: forewing with Sc to costa distinctly before middle, hindwing with M and Cu veins very short, M2 and M3 separate.

Abdomen. In males, dorsal surface uniformly pale grey or grey drab, with light greenish, reddish, or pale golden metallic lustre; ventral surface shiny white iwth some very pale yellow tinge; terga 1-7 moderately sclerotized, anteriorly margined; sterna 1-7 well to markedly sclerotized, unmargined, or S4-S7 antero-laterally with suggestion of margin. In females, dorsal surface grey-drab or ochreous-drab, slightly or moderately iridescent, in many specimens variously mixed with some pale grey, in some specimens with some scattered olive-brown; ventral surface with S1-S6 white, in some specimens with some very pale yellow and with lateral portions of S1-S3 grey-drab; S7 olive-brown mixed with ochreous; terga and sterna 1-6 moderately sclerotized, terga unmargined, sterna anteriorly indistinctly margined; T7 and S7 markedly sclerotized; T7 subquadrate; S7 (Fig. 312) as long as wide, with anterior margin broadly and shallowly emarginate and surface with medial longitudinal groove in basal half, latero-caudal angles rounded, caudal margin ± straight, medially with membranous lobiform appendix.

Male genitalia (Figs. 194-198). 8th segment (Figs. 197-198) markedly sclerotized, enlarged, enclosing genitalia. T8 (Fig. 197) elongate-subrectangular, dorsal surface medially concave, caudal margin medially protruded, projection apically indented. S8 (Fig. 198) transverse, anteriorly broadly and roundly emarginate, caudally produced into spiniform projection. Tegumen in dorsal aspect (Fig. 195) ± parallel-sided, anteriorly with narrow, deep V-emargination about half length of tegumen; in lateral aspect (Fig. 194) sides triangular. Uncus as ± rounded plate with two small, latero-dorsal, apically bilobate projections with tuft of few fine setae. Gnathos basally as heavy horseshoe-shaped plate with rounded portion caudal and with dorsal, anteriorly projected tooth on each side; distal projection extended ventrally from basal horseshoe plate, distally tapered, apex asymmetrically twisted beneath apex of aedeagus and with small warped plate (Fig. 196). Vinculum as in *S. limbella* except markedly convex, conical in ventral aspect, antero-dorsal angle extended above pedunculi. Valvae blade-like, distal half moderately bent ventrally and with inner wall densely setose; base fused to vinculum. Juxta moderately heavy, L-shaped, attached subbasally to aedeagus and ventrally articulated to contiguous base of valvae. Aedeagus downcurved, tubular, dorso-medially bulged; bulbous ejaculatorius small, subcrescentic.

Female genitalia (Fig. 313). T8 lightly sclerotized anteriorly and laterally, otherwise membranous, caudal margin with few fine setae. S8 (Fig. 313) anteriorly elevated, with moderately sclerotized, transverse band, rest of surface mostly membranous, uneven, with marked transverse wrinkles and medial hump, caudally with a small sclerite on each side of hump, latero-caudal angles with cluster of few fine setae. Sterigma undeveloped. Ostium relatively small, on S8 just behind transverse sclerotized band, with narrow, slightly sclerotized antrum. Ductus bursae membranous, ribbon-like, inception on antero-lateral portion of bursa. Corpus bursae (Fig. 375) narrowly elongate, anterior portion dilated, caudal portion gradually narrowed into ductus seminalis. (Spermatheca not studied). Anterior apophyses straight, ± parallel, about 3x length of T8, extended laterally on S8 almost to its caudal margin. Posterior apophyses slightly thinner than, and almost as long as, anterior ones. Ovipositor relatively short, about 0.25x length of T1-T7; papillae anales membranous.

Variation. — In coloration, most specimens examined have the typical trifasciate pattern of forewings (Figs. 9-11), but the dark ground color varies from drab to dark olive-brown, with most specimens being olive-brown. However several specimens from the northeastern part of the range (New Jersey, Iowa, Illinois) have indistinct or very indistinct fasciae and the basalmost and medial transverse fasciae joined together by an elongate fascia in fold (Fig. 13). In some of the specimens with the joined proximal fasciae, the forewings appear to have a single elongate fascia, rather than two transverse fasciae, in the basal third. A few specimens have the basal half behind the fold mostly covered by an elongate, more or less diffuse whitish fascia, and have no distal fascia (Fig. 14). Specimens from Florida (Fig. 12) have the ground color of forewings almost tan with the fold dark brown between the white fasciae, giving them an almost tessellate appearance.

In male genitalia, the elongation and width of the caudal projection of tergum 8 and depth of its apical indentation vary slightly. The spine of sternum 8 is pointed in most specimens examined, but blunt in a male from British Columbia. The paired dorsal projections of the uncus are moderately elongate and bilobate in most specimens from various regions, short and blunt in specimens from Florida. The dorsal teeth of the gnathos are blunt and markedly anteriorly projected in most specimens, acute and dorsally projected in specimens from Florida. The valvae vary from blade-like with the apical portion obliquely truncate and the apex pointed, to subspatulate with the apical portion rounded; all intermediates were represented among specimens examined, with no shape being predominant. Overall, however, Florida males exhibit the most divergent variation in genitalia. Variation in female genitalia was not examined.

Phylogenetic relationships. — This species is closely related to *S. ypsilon* Braun and to two undescribed species from California and Nevada, with which it forms a small monophyletic species group related, or belonging, to *Scythris s. str.* Synapomorphies of the group are in males the joint enlargement of tergum and sternum 8, and gnathos with a thick, protruded base and apically twisted distal arm ended in a small, warped plate.

Geographical distribution and period of flight. —Known to range widely from the Atlantic coast north to Massachusetts, west to Arizona, Utah, Idaho and north to southcentral British Columbia, south to the states of Tamaulipas and Durango in México (Fig. 404). It appears more predominantly southern within its known range, as suggested by the greater abundance of specimens collected in the southern half of the United States compared to isolated records from the northern part of the range. In Texas and Florida, adults have been collected at blacklight.

Hostplant. — Two specimens from Manhattan, Kansas reared from pigweed, *Amaranthus retroflexus* L. (Amaranthaceae) (USNM). One specimen from Decatur, Illinois reared from undetermined amaranth (USNM). One specimen from Brownsville, Texas labelled: "on beets". One specimen from Millerton, Oklahoma labelled "cotton".

3.3.9 *Scythris ypsilon* **Braun**

(Figs. 15-16, 199-202, 314-315, 376, 404)

Scythris ypsilon Braun, 1920: 41.— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist].

Type material. — HOLOTYPE male in ANSP, labelled: "Loma Linda/ VIII.31 Cal./ G.R. Pilate" [white, printed]; "TYPE/ Collection of/ Annette F. Braun." [red, printed]; "Scythris/ ypsilon/ Type Braun" [white with top and bottom borders black-lined, handwritten]; "[male symbol] genitalia on/ slide no./ JFL-85-0275/ by J.F. Landry/ ANSP coll." [green, partly printed, partly handwritten, added by me]; "ANSP" [pale yellow, printed, two back to back]. I dissected the abdomen and genitalia and mounted them on slide no. JFL-85-0275.

PARATYPES, five males and three females (ANSP); collection labels as holotype except for dates: 1 male, "vi.30.12"; 1 male and 1 female, "vii.11.12"; 1 male and 1 female, "viii.21"; 1 male, "ix.14"; 1 male and 1 female, "x.15". All paratypes bear a small red label marked

"Paratype" in Braun's handwriting. The female collected on "x.15" is without head, metathorax, hindwings and abdomen. The female collected on "vii.11.12" bears two additional labels: 1) "Scythris/ ypsilon/ Paratype Braun" [white with black upper and lower margins, in Braun's handwriting]; 2) "PARATYPE/ Scythris/ ypsilon/ Braun" [blue, not Braun's original].

Type locality. — Loma Linda, San Bernardino Co., California.

Recognition. — Adults are medium-small scythridids with a color pattern of forewings similar to that of *S. trivinctella* , but with much paler brown or drab ground color with pronounced golden metallic lustre, broader cream-color fasciae and with an additional white spot in apical portion (Fig. 15-16). Males of *S. ypsilon* can also be distinguished by the greatly enlarged sclerites of the 8th abdominal segment: sternum 8 (Figs. 201-202) is distally produced into an upcurved projection with the apex broadened, laterally compressed and digitate, tergum 8 (Fig. 200) has a ventral, L-shaped projection which extends ventrad and is bent beneath the projection of sternum 8, the more elongate and caudally projected lobes of uncus, the markedly downcurved aedeagus, and the vinculum almost as long as the valvae (Fig. 199). Females can be distinguished from those of *S. trivinctella* by the transverse, shallow invagination of tergum 7 (Fig. 314), and the lack of a transverse sclerotized band and of distinct transverse wrinkles on sternum 8 (Fig. 315).

Description. — Size. Forewing length 4.5-5.2 mm (mean = 4.7); hindwing length 3.6-4.5 mm (mean= 4.0); wing expanse 9.8-11.4 mm (mean = 10.5)(10 specimens).

Head. Face and neck tufts in most specimens cream-color or yellowish with light golden metallic lustre and light greenish or purplish hue; in few specimens pale drab with similar hue and lustre. Eye relatively large, almost as wide as frons. Haustellum about two-third length of body, base clothed with whitish scales. Maxillary palpi conspicuous, extended over base of haustellum. Labial palpi rather short, almost porrect or very slightly upcurved; if upcurved then extended to dorsal margin of eye; whitish or cream-color, in some specimens ventrally suffused with pale fuscous. Antenna extended to two-third length of forewing, bright metallic golden; in males ventral side distinctly ciliate, indistinctly so in females.

Thorax. Dorsal surface whitish, yellowish or pale brown with marked metallic golden lustre; in some specimens tegulae with basal half golden, distal half white. Ventral surface white with light metallic golden lustre. Legs with inner side and basal half of outer side white or cream-color; outer side of tibiae and tarsi markedly metallic golden, on mid- and hind legs interrupted by apical, cream-color band.

Wings. Frenum present. Forewing shaped as in *S. trivinctella* ; upper surface brown or pale brown with marked metallic golden lustre, with three broad, irregular, obliquely transverse cream-color fasciae: one extended over most of base to costa at about one third of wing length, one from coastal third where confluent with basal fascia and extended to hind margin at middle of wing, and one extended from proximal end of termen to costa at two-thirds of wing length; in most specimens with subapical cream-color spot; ventral surface pale fuscous brown suffused with some olive-brown, with some whitish in apical portion; cilia brown or golden. Hindwing shaped as in *S. trivinctella* ; upper surface pale brown or fuscous brown, with faint purplish metallic hue; ventral surface pale drab-brown, cell area, mostly along fold, cream-color or pale yellowish; cilia brown; female frenulum with three bristles. Venation as in *S. trivinctella* .

Abdomen. In males, upper surface cream-color lightly suffused with metallic golden, or grey suffused with some pale fuscous and with iridescent hue; ventral surface whitish with light golden lustre; T1-T2 (as seen in potash-cleared specimens) slightly sclerotized, T3-T7 indistinctly sclerotized; T2-T6 anteriorly finely margined; T8 (Fig. 200) markedly sclerotized and developed, about as long as T4 +T5+T6, oblong, moderately convex, latero-apically with irregular, somewhat asymmetrical edge, medio-apically U-emarginate, right inner edge of emargination ventrally with L-shaped process extended ventrad to level of S8 and with apex curved beneath distal projection of S8; S1-S7 distinctly sclerotized, unmargined; S8 (Fig. 201-202) markedly sclerotized and developed, about as long as T8, basal half convex, subquadrate, anteriorly with deep and wide V-emargination, distal half markedly narrowed and produced into upcurved, thick projection extended to slightly above T8 between U-emargination; apical half of projection dilated, laterally compressed, dorsally with digitiform lobe. In females dorsal surface with T1 cream-color or yellowish, T2-T5 ochreous, rufous brown or pale olive-brown; T6-T7 cream-color or buff suffused with pale brown; all terga laterally white; T1-T5 with light metallic lustre and iridescent hue; ventral surface mostly white, S7 in most specimens yellowish; terga and sterna 1-6 (as seen in potash-cleared specimens) moderately sclerotized, T2-T4 anteriorly finely margined, T5-T6 and sterna unmargined; T7 (Fig. 314) elongate-rectangular, convex, medially with transverse invagination; S6 with shallow medio-longitudinal, indistinctly sclerotized groove; S7 suborbicular or subquadrate, distally slightly narrowed, caudal edge with narrow U-emargination, membrane of emargination prolonged into linguiform lobe.

Male genitalia (Fig. 199). Similar to those of *S. trivinctella* except as follows. Tegumen anteriorly very shallowly emarginate. Uncus U-shaped in dorsal aspect, lateral projections with small, setose ventral lobe. Gnathos as in *S. trivinctella* except horseshoeshaped base with rounded dorsal humps. Vinculum narrowly elongate, extended almost to apex of valvae, ventro-longitudinally carinate. Valvae almost straight, distally slightly broadened. Juxta almost straight, obliquely projected dorsad. Aedeagus markedly down-arched, apex narrowly tapered.

Female genitalia (Figs. 315, 376). T8 short, membranous except for narrow band on anterior and lateral margins; medial area longitudinally finely striulate; caudal margin finely setose. S8 (Fig. 315) short, membranous except two very small, lightly sclerotized, subapical patches, indistinct, caudo-medial, bilobate patch, and posterior angles; posterior angles with 6-8 setae; membrane smooth or very indistinctly wrinkled. Sterigma undeveloped. Ostium as in *S. trivinctella* . Ductus bursae very fine, delicate, inception on left side of anterior third of bursa. Corpus bursae (Fig. 376) irregularly oblong, anterior third slightly constricted and bent to right; distally abruptly narrowed into ductus seminalis. (Spermatheca not examined). Anterior apophyses straight, parallel, basally sinuate and extended along lateral margin of T8; free portion longer than T8. Posterior apophyses thinner and slightly longer than anterior apophyses. Ovipositor very short, about length of T8; papillae anales with lightly sclerotized patch at point at attachment of posterior apophyses.

Variation. — Darker specimens (Fig. 15) have a golden brown appearance whereas paler specimens (Fig. 16) have a golden yellow appearance. Specimens examined showed slight variation in the irregular shape of the pale fasciae of forewings but much less so than observed in *S. trivinctella* . Variation in genitalia was not examined.

Phylogenetic relationships. — *S. ypsilon* is closely related to *S. trivinctella* based on the synapomorphic features of apex of distal projection of gnathos which is twisted and ended in a small warped plate, and shape of the protruded base of the ganthos.

Geographical distribution and period of flight. — Known only from south and central California (Fig. 404). Adults are possibly both diurnal and nocturnal: they have been collected at light and on *Euphorbia* (Euphorbiaceae). Adults have been collected in May, the first half of July and in September, suggesting that there are at least two generations per year.

Hostplant. — Unknown.

3.3.10 *Scythris anthracina* Braun

(Figs. 25-26, 220-223, 326-327, 385, 411)

Scythris anthracina Braun, 1923b: 123.— McDunnough, 1939: 91[checklist].— Hodges *et al.*, 1983: 19 [checklist].

Type material examined. — HOLOTYPE male in ANSP, labelled: "Palm/ Springs,/ Cal. 3-25-17." [white, handwritten]; "TYPE/ Collection of/ Annette F. Braun." [red, printed];

"Scythris/ anthracina/ Type Braun" [white, with black-lined top and bottom borders, handwritten]; "[male symbol] genitalia on/ slide no./ JFL-85-0269/ by J.F. Landry/ ANSP coll." [green, printed with male symbol and number handwritten]; "ANSP" [pale yellow, printed]. Abdomen and genitalia dissected and mounted on slide no. JFL-85-0269. ALLOTYPE female (ANSP) labelled same as holotype, except for collecting date "3.26" (no year indicated but possibly the same as for the holotype); abdomen detached and in a small microvial pinned under the specimen.

PARATYPES, six males (ANSP), with collection label same as that of holotype, except one specimen with date as "3-28"; three specimens are double-mounted on the same cork block; all specimens with additional label: "Paratype" [red, in Braun's handwriting]; one specimen with two other additional labels: "Scythris/ anthracina/ Paratype Braun" [white with black-lined upper and lower margins, in Braun's handwriting]; "PARATYPE/ Scythris/ anthracina/ Braun" [blue, partly printed, partly handwritten, not Braun's original].

Type locality. — Palm Springs, Riverside Co., California.

Recognition. — Adults are small, rather non-descript scythridids with grey or greyish, white-peppered, or mostly whitish or dirty white, forewings (Figs. 25-26). They are best distinguished from other scythridids by the male T8 (Fig. 223) with teeth on the apical margin and genitalia with widely separated tegumen halves joined medially by a U-shaped uncus, hook-like dorso-distal projection of gnathos and rod-like, markedly upcurved, parallel valvae (Figs. 220-222). Dark specimens (Fig. 25) are similar in coloration to three undescribed, closely related species occurring in southern Arizona and California. Specimens of *S. anthracina* are distinguished from these three species, in the males, by the shape of T8 with apical teeth and, in the females, by the streak of black scales along the hind margin of dorsal surface of hindwings, and black scales on the pleural areas.

Description. — Size. Forewing length 3.6 - 4.7 mm; hindwing length 3.2 - 4.1 mm; wing expanse 8.0 - 10.3 mm (10 specimens).

Head. Face drab with some white laterally around eyes, to buff-yellow or cream-colored in light specimens, or with mixture of olive-brown, buff and white scales of peppery appearance in dark specimens; neck tufts white. Eyes of moderate size, slightly narrower than frons. Haustellum base covered with white to olive-brown scales, variously mixed. Maxillary palpi conspicuous, folded over base of haustellum. Labial palpi extended to level of vertex, mostly white or whitish, articles 2 and 3 ventrally with variously extended annulation of darker, olive-brown scales; annulation indistinct in pale specimens. Antenna about three-quarter length of forewing, uniformly drab to olive-brown, except ventral portion of scape and pedicel white; in some pale specimens, white extended over most of dorsal portion of scape and pedicel.

Thorax. Dorsal surface uniformly white or cream-colored in pale specimens, to whitish lightly suffused with brownish, or peppery with even mixture of olive-brown and whitish scales in dark specimens. Ventral surface mostly white. Legs mostly white or whitish, lightly suffused with buff-yellow, clay-colored or olive-brown scales, suffusion denser in dark specimens. Tarsi, mostly on ventral surface, darker than rest of legs, light clay-colored to olive-brown.

Wings. Frenum present. Forewing elongate-lanceolate; dorsal surface with light to moderate reddish iridescence; in pale specimens entirely whitish with very scattered to moderately dense suffusion of buff-yellow or light clay-colored scales; in dark specimens, dorsal surface of greyish-brown or olive-brown peppery appearance from olive-brown ground-color suffused with white; in moderetely dark specimens, ground color light drab. Ventral surface in males uniformly drab or greyish in dark specimens, to dirty light clay-colored or cream-colored in pale specimens; in females, dirty cream-colored with light reddish iridescence and with broad streak of shiny, charcoal-black, iridescent scales above cubital fold extended from apex of subdorsal retinaculum to two-thirds or three-quarters of wing and, in some specimens, with few scattered black scales medially posterior to fold. Cilia buff-yellow or cream in light specimens to drab in dark specimens. Hindwing narrowly elongate-lanceolate, apex pointed, termen almost straight; upper surface in males ochreous or light drab, darker apically, with light iridescence; ventral surface dirty white; upper surface in females dirty white to light drab with streak of shiny, charcoal-black iridescent scales medially behind cubitus; ventral surface dull cream-colored. Cilia as on forewing. Venation not studied.

Abdomen. In males, dorsal surface whitish, gray, ochreous or pale drab with light metallic luster and moderate to marked iridescence; anal tuft medially drab, laterally whitish; ventral surface iridescent whitish with few scattered drab scales; T1-T2 (as seen in potash-cleared abdomen) lightly sclerotized, T3-T7 and sterna nearly membranous, unmargined; T8 markedly sclerotized, elongate-rectangular, medially constricted, anterior margin laterally projected into short, incurved apodemes extended cephalad inside abdomen and caudad over lateral portions of T8 as rods; caudal margin straight or slightly sinuate, medially with three to six teeth. In females, dorsal surface mostly dull cream-colored; basal half of T1, medial and lateral portions of T2 and, in some specimens, more scatteringly of T3-T6, with shiny, charcoal-black, strikingly iridescent scales with emerald-green reflection; ventral surface white, apical margin of S7 deeply emarginate (distinct on dry specimens), emargination not covered by scales; segments 1-7 nearly membranous; T7 slightly sclerotized, elongate-rectangular, slightly narrowed medio-laterally; intersegmental membranes between T3 and T7 each with medial invagination filled with dehiscent black scales (Fig. 327); S7 elongate-rectangular, posterior margin V-emarginate with two medial, blunt, triangular projections (Fig. 326).

Male genitalia (Figs. 220-222). Symmetrical, open in dorsal aspect (Fig. 221). Tegumen reduced in extent, divided into two lateral, subtriangular and widely separated halves. Uncus brace-like, with few small setae ventrally near articulation. Gnathos with basal portion transversely subrectangular, attached laterally to ventro-lateral margin of tegumen, junction of basal arms medially produced into darkly sclerotized, upcurved, hook-like process (Fig. 220); distal arm with small, warped, apical plate protruded caudad under apex of aedeagus. Vinculum shaped as transversely rectangular, vertically oriented plate. Valvae narrow, slightly tapered, markedly upcurved, parallel rods; base fused to vinculum. Aedeagus tubular, distally tapered, subpointed, base laterally explanate and dorsally with narrow crest; medially bent ventrad and articulated to dorsal margin of vinculum and braced between base of valvae; bulbus ejaculatorius small, about size of aedeagus, subcrescentic.

Female genitalia (Fig. 326). T8 and S8 indistinctly sclerotized; S8 medially with microsculpture of fine transverse lines and anteriorly with small, similarly sculptured, U-shaped sclerite. Sterigma not developed. Ostium very small, situated medially on surface of posterior margin of S7. Ductus bursae very fine, sclerotized for very short distance behind ostium, otherwise membranous; inception on corpus bursae at anterior end of bursa. Corpus bursae (Fig. 385) subovoid. Spermatheca not examined. Anterior apophyses slightly longer than S7, thin, divergent, extended on sides of T8; extension slightly shorter and distinctly thinner than free portion; apophyses joined by U-bent, cross-bar at anterior margin of T8. Posterior apophyses extremely thin, almost four times length of anterior apophyses. Ovipositor (segments 9+10) quite short, slightly longer than segment 8 (the latter, narrow and submembranous, possibly forms part of the functional ovipositor). Papillae anales membranous.

Variation. — Adult specimens are varied mostly in color of the dorsal surface, most notably on the forewings, from pale, creamy white in pale specimens (Fig. 26) to a grey, peppered appearance in dark specimens (Fig. 25). No seasonal or geographic pattern is apparent in the range of variation shown in specimens examined. Females are varied in extent of visible black scales on dorsum of the abdomen: on some specimens, they are visible only on the base of T1 and more sparsely on the pleural area of segments one to five; on other specimens, they form a patch medially on T1, T2 and, in some, T3 giving the appearance of a gradually narrowed streak on the basal portion of the abdomen, in addition to being sparsely distributed on the pleural area. Actually black scales cover most of the surface of T1-T6 but are overlaid by white scales and thus not all visible. In males, the number of apical teeth on T8 varies from three to five. No significant variation was observed in male genitalia. Variation was not studied in female genitalia.

Phylogenetic relationships. — This species is most closely related to five undescribed species occurring in the southwestern United States which all have similar male genitalia with similarly shaped uncus, gnathos and valvae.

Geographical distribution and period of flight. — Known to range in southwestern United States from southern California east to westernmost Texas (Fig. 411). Adults occur in the spring from late March to late June. In Arizona specimens were also collected in the fall from mid-September to mid-October. Adults have been collected at blacklight and are crepuscular or nocturnal.

Hostplant. — Unknown.

3.3.11 *Scythris basilaris* (Zeller)

(Figs. 17, 154, 203-207, 318, 379, 421)

Butalis basilaris Zeller, 1855: 230.— Stainton, 1872: 40 [note about synonymy].— Chambers, 1878c: 133 [referenced list].—Walsingham, 1888: 114 [note about synonymy].— Smith, 1891: 107 [checklist].

Scythris basilaris ; Dyar, 1902: 538 [catalogue].— Smith, 1903: 117 [checklist].— Barnes and McDunnough, 1917: 190 [checklist].— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist].

Butalis flavifrontella Clemens, 1860: 126.— Stainton, 1872: 40 and 126 [notes about possible synonymy with *basilaris*].— Zeller, 1873: 92 [note about possible synonymy with *basilaris*].— Chambers, 1874: 8 [notes about distribution and variation].— Chambers, 1878c: 133 [referenced list].— Walsingham, 1888: 114 [proposed synonymy with *B. basilaris* Zeller].— Smith, 1891: 107 [as a synonym of *B. basilaris* Zeller]. Synonymy confirmed.

Scythris flavifrontella ; Dyar, 1902: 538 [catalogue].— Barnes and McDunnough, 1917: 190 [checklist].— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist] [all citations as a synonym of *S. basilaris* (Zeller)].

Notes about synonymy. — Although I did not dissect the genitalia of the type of *S. flavifrontella*, I regard it as conspecific with *S. basilaris* based on coloration and structure of the sterigma and hind margin of tergum 8 (examined by denuding apex of the dry abdomen).

The name *S. flavifrontella* (Clemens) has been omitted from Smith's (1903) checklist.

Type material. — ***Butalis basilaris*** : type material in BMNH and not examined.

Butalis flavifrontella : HOLOTYPE female in ANSP, labelled: "84" [small, pink, handwritten label placed under specimen on minuten]; "TYPE/ Butalis/ flavifrontella/ B. Clemens/ 7477" [red, partly printed, partly handwritten, seemingly new and probably not original; the type number is written across the right side]; "Butalis/ flavifrontella/ Clemens/ Type!/ AB 1902" [white, handwritten with lower margin thinly red-bordered]; "ANSP" [pale yellow, printed]. The specimen is not dissected.

Type locality. — ***Butalis basilaris*** : North America, as given by Zeller. ***Butalis flavifrontella*** : not given by Clemens, but probably Easton, Northampton Co., Pennsylvania (Hodges 1986: 36).

Recognition. — Adults are medium-sized scythridids with the upper surface of body very dark brown, the forewings with a golden or yellowish streak in fold extended from base to about one third and a similarly colored apical patch (Fig. 17), very long and prominent hind tibial brush, and, in males, a dense anal tuft. The pattern of golden-yellow markings of the forewings over the dark brown ground color distinguish adults of *S. basilaris* from those of all other Nearctic scythridids. In male and female genitalia, they resemble the closely related *S. eboracensis*. Males of, *S. basilaris* differ from those of the latter in proportions of S8, which has the anterior the anterior apodemes parallel and separated by a distance almost equal to the maximum width of the sternum, the medial, transverse portion shorter than the anterior apodemes, the latero-posterior projections longer than the length of the combined medial portion and anterior apodemes, and the anterior margin rounded (Figs. 205-206; compare with Fig. 209)). Females differ in the gradually tapered sterigma, the shallow emargination of caudal margin of S7 which is incised about one quarter the length of the sternum, the inner fold of S7 which extends about one third the length of the sternum, and the broadly oval, distinctly sclerotized S8 (Fig. 318; compare with Fig. 319)).

Description. — Size. Forewing length 5.7-7.0 mm (mean = 6.4); hindwing length 4.5-6.0 mm (mean= 5.2); wing expanse 12.8-15.5 mm (mean = 14.1)(10 specimens).

Head. Face and neck tufts in most specimens dark brown, olive-brown or rufous brown, with marked purplish tinge; clypeal area yellowish; in some specimens, entire face yellowish or metallic golden. Eye relatively small, markedly narrower than frons. Haustellum base with yellowish, brownish or greyish scales. Maxillary palpi small, conspicuous, folded over base of haustellum. Labial palpi moderately upcurved, extended to, or nearly to, level of vertex; article 1 and most of inner side of articles 2 and 3 yellowish, outer side of 2 and 3 mostly brown; in some specimens, most of 2 and 3 yellowish with some brown suffusion. Antenna slightly thickened, submoniliform, extended to about two-third length of forewing, dark brown with marked purplish tinge, ventrally densely ciliate; scape only slightly broader than other articles, without pecten.

Thorax. Dorsal surface uniformly dark brown or dark maroon-brown, with marked purplish hue. Ventral surface grey or metallic silvery; in many specimens, area near below tegula metallic golden. Legs olive-brown or greyish with light purplish hue; in many specimens, hind leg paler; brush of hind tibia erect, very long, extended to middle of tarsus, hairs of brush almost as long as tibia.

Wings. Frenum present. Forewing lanceolate, apex pointed, ternum slightly sinuate (Fig. 154); upper surface very dark brown with marked purplish hue, in most specimens with yellowish or golden streak in fold from base to one third and similarly colored apical patch (Fig. 17); in some specimens yellowish streak and patch indistinct, in few specimens streak lacking; ventral surface in males dark brown, olive-brown or dark grey, in females rufous brown or brown with, in many specimens, posterior half cream-color; fringe brown. Hindwing narrowly elongate-lanceolate, apex pointed, termen very slightly sinuate; upper surface pale or dark brown with light purplish hue, rather sparsely scales; ventral surface colored as that of forewing; fringe brown. Venation (Fig. 154) as in *S. limbella* except as follow: forewing with R4+5 fork very short and stalk relatively long, base of M1 proximate to, or forked with, R4+5; hindwing with Sc+R1 extended to margin before middle, M2 and M3 separate, CuA1 and CuA2 very short at margin. Female frenulum with two bristles.

Abdomen. Dorsal surface, in males colored as that of thorax, in females dark brown moderately suffused with tan or buff and with purplish, bluish or slightly iridescent hue. Ventral surface, in males S2-S6 cream-color, S7-S8 colored as dorsal surface, apical tuft very dense and thick, apex thus with broad, truncate appearance; in females S2-S3 greyish or drab, S4-S7 cream-color, distal half of S7 olive-brown. In males (as seen in potash-cleared specimens), terga darkly sclerotized, anteriorly margined; sterna moderately sclerotized, S2-S5 unmargined, S6-S7 anteriorly finely margined. In females, T1-T6 moderately to slightly sclerotized, anteriorly margined; S1-S6 lightly sclerotized; T7 and S7 markedly sclerotized; T7 elongate-rectangular; S7 transversely rectangular and convex, distal portion folded inwardly, fold extended to one third length of sternum, caudal margin medially with broad, rounded emargination, depth of emargination about one quarter length of sternum (Fig. 318).

Male genitalia . T8 (Fig. 207) small, anterior margin broadly V-emarginate, caudal margin rounded. S8 (Figs. 205-206) enlarged, modified, markedly sclerotized; antero-lateral angles prolonged into short, heavy apodemes extended inward almost to anterior margin of S7, distance between apodemes almost equal to maximum width of sternum; caudal margin medially shallowly concave, lightly sclerotized or transluscent; latero-posterior angles prolonged into long, heavy, slightly douwcurved, acuminate processes with small, subapical tuft of stiff setae, length of processes greater than rest of sternum and apodemes combined. Genitalia proper (Figs. 203-204) small, symmetrical, compact, surrounded by S8. Tegumen elongate, capsuliform, enclosing aedeagus-juxta complex; anterior portion constricted in dorsal aspect, margin V-indented; caudal margin bilobate; ventral side of lobes with subapical, shallow concavity. Uncus bilobate, transluscent, horseshoe-shaped in dorsal aspect. Gnathos absent. Socii two small, barely protruded, indistinctly sclerotized, setose lobes subapical on inner margin of tegumen. Vinculum projected caudally below valvae, in ventral aspect subtriangular, medially with longitudinal carina; base as vertical, convex plate. Valvae simple, rod-like, straight, divergent (in form of V in dorso-ventral aspect; Fig. 204)), distally with few long setae, base fused to basal plate of vinculum. Juxta (?) basally fused to base of vinculum, extended dorso-caudad as heavy, trough-like process wedged between narrow ventral cavity of tegumen, apex subcontiguous to socii, bilobate, lobes with very darkly sclerotized, apex; ventrally with lateral row of fine setae. Aedeagus deeply recessed under tegumen, stubby, diminutive, ventrally ankylosed by narrow flap extended from base and articulated to pre-apical portion of juxta; in lateral aspect bird-head-like, dorso-medially humped, apex narrow, beak-like. Bulbus ejaculatorius rather small, crescentic.

Female genitalia (Figs. 319, 380). T8 elongate-rectangular, sides slightly rounded, well sclerotized, medial area membranous with fine longitudinal striulae. S8 well sclerotized, broadly oval, concave, sides with irregular row of few fine setae, anterior third to half recessed under S7. Sterigma developed, as elongate, gradually tapered, upcurved cone about two-thirds length of S8, situated at anterior margin of S8, basal half overlapped by S7. Ostium very small, at apex of sterigma, oriented caudad. Ductus bursae fine, rubbon-like, membranous, inception medio-laterally on left side of bursa. Corpus bursae (Fig. 380) in ventral aspect subovoid, left side medio-laterally with rounded dilatation, in lateral aspect sub-ellipsoid; caudal portion abruptly narrowed into ductus seminalis. (Spermatheca not studied.) Anterior apophyses slightly shorter than T7, straight with short pre-apical sinuation, slightly divergent. Posterior apophyses thin, about 1.5x length of anterior ones, point of insertion onto ovipositor wall with very small sclerotization. Ovipositor about 0.4x length of T1-T7; papillae anales membranous.

Variation. —Most specimens have the face colored as the dorsal surface of thorax, with some yellowish in the clypeal area. In some specimens however, the head is entirely yellowish or golden yellow. In some specimens, the golden streak of forewing, or the apical patch, or both, are indistinct and in few, one or the other is lacking. In most such specimens however, one can see traces of yellow under magnification. The genitalia do not vary significantly in the few preparations examined, and examination of specimens from different regions indicates that diagnostic differences between *S. basilaris* and *S. eboracensis* are probably constant. However, study of larger samples of genitalia preparations will be necessary to establish more firmly structural limits of these species.

Note about structure of juxta. — It is uncertain whether the structure described above as the juxta is correctly interpreted. The process described is topographically in the position of the juxta, and shape of the divided apex reminds of that of the juxta of some oecophorids. However the base is solidly fused with the anterior portion of the vinculum, with no trace of a fusion line left. It is thus possible that this so-called juxta is actually a dorso-median process of the vinculum (not a saccus however, because it extends from the dorsal margin of the vinculum and projects caudad), and that the true juxta is the small flap that is fused baso-ventrally to the aedeagus and articulated pre-apically on the vincular process. These comments also apply to the similarly structured genitalia of *S. eboracensis* .

Phylogenetic relationships. — *S. basilaris* is closely related to *S. eboracensis* . These two species form a monophyletic group that is generically distinct from *Scythris s. str* .

Geographical distribution and period of flight. — Known to range in eastern North America, from southern Ontario south to Florida, west to Iowa (Fig. 421); most records are from the northeast. Adults occur from mid-June to mid-July and are probably diurnal.

Hostplant. — Unknown. A specimen from Long Island, New York bears a label stating "very common species on 'Jersey Tea'" (*Ceanothus americanus*, Rhamnaceae), which is a possible hostplant.

3.3.12 *Scythris eboracensis* (Zeller)

(Figs. 18, 91, 208-209, 319, 380, 422)

Butalis eboracensis Zeller, 1855: 205.— Zeller, 1873: 94 [redescription].— Chambers, 1878c: 133 [referenced list].— Smith, 1891: 107 [checklist].

Scythris eboracensis ; Dyar, 1902: 538 [catalogue].— Smith, 1903: 117 [checklist].— Barnes and McDunnough, 1917: 190 [checklist].— Forbes, 1923: 350 [misidentification].— McDunnough, 1939: 91 [checklist].— Hodges, 1978, pl.1, fig. 2 [misidentification].— Hodges *et al.*, 1983: 19 [checklist].— Covell, 1984: 438 [misidentification].

Butalis fuscicomella Clemens, 1860: 169.— Stainton, 1872: 126.— Zeller, 1873: 92 [comparison with *B. eboracensis*].— Chambers, 1874: 8 [distribution record].— Chambers, 1878c: 133 [referenced list].— Smith, 1891: 107 [checklist]. **Tentative new synonymy.**

Scythris fuscicomella ; Dyar, 1902: 538 [catalogue].— Smith, 1903: 117 [checklist].— Barnes and McDunnough, 1917: 190 [checklist].— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist].

Type material examined. — *Butalis eboracensis* : Type material in BMNH and not examined. According to Zeller (1855: 206), it consists of a single male from New York. According to J. A. Powell (pers. comm. 1984) the type is a female apparently from Texas.

Butalis fuscicomella : HOLOTYPE female in ANSP, labelled: "83" [small pink label, handwritten, placed on the minuten pin under the specimen]; " TYPE/ Butalis/ fuscicomella/ B. Clemens/ 7478" [red, partly printed, partly handwritten, with number written across right side; label seemingly new, possibly not original]; "Butalis/ fuscicomella/ Clemens/ Type/ AB 1902" [handwritten, white with lower margin thinly red-bordered; probably added by Busck]; "[female symbol] genitalia on/ slide no./ JFL-85-0280/ by J.F. Landry/ ANSP coll." [green, partly printed, partly handwritten, added by me]. Abdomen and genitalia dissected and mounted on slide no. JFL-85-0280.

I also examined a male from the USNM collection labelled as follow: "[male symbol]"; "Butalis/ fuscicomella/ Clem. compared with type/ Mus. Ent. Soc Phil. 1871" [white, handwritten by Walsingham]; "Fernald" [yellow, printed]; "[male symbol] genitalia/ on slide/ AB May 2. 1927". Busck's slide is labelled: "Butalis/ fuscicomella/ Clem. Comp. w. type/ in Phila by/ Lord Walsingham/ 1871"; "AB May 2. 1927". This specimen is not conspecific with the female holotype. The genitalia show that it belongs to the same genus as *S. impositella* (see below under heading "Phylogenetic relationships").

Type localities. — *Butalis eboracensis* : New York, as given by Zeller (but see note about type material above). *Butalis fuscicomella* : Not given by Clemens, but probably Easton, Northampton Co., Pennsylvania (Hodges1986: 36).

Notes about identity and synonymy. — There are two very similar and closely related species occurring sympatrically in eastern North America, which have been repeatedly confused with each other and both labelled as *S. eboracensis* . Both agree in extent of external structural features and color with Zeller's description of *S. eboracensis* , especially with respect to the violet-black hue of forewings, the long and thick anal brush of males and the long tibial brushes of the hindlegs. These features are possessed by no other externally similar species. The two species are distinct from each other in male and female genitalia and in the thickness of antennae. Adults of one species have the proximal two-thirds or three-quarters of the flagellum distinctly thickened (Figs. 18, 91), whereas those of the other have a thin, filiform flagellum throughout (Figs. 19, 92). Even though I have not examined the type of *S. eboracensis* , I associate the name with the species whose adults have thick antennae, because Zeller clearly indicates this feature in his description. The type of *S. fuscicomella* also has thick antennae, and has genitalia similar to those of all other females with thick antennae. Hence *S. fuscicomella* falls into synonymy with *S. eboracensis* , albeit tentatively pending examination of the type of *S. eboracensis* . From a comparison of descriptions, Zeller (1873: 92) considered the possibility that both nominal species might be synonymous but rejected it on the basis of slight color differences. The yellowish tint of forewings described by Clemens for *S. fuscicomella* and regarded by Zeller as an indication of specific distinctiveness is due to the worn condition of the type specimen.

There is another undescribed species very similar in external appearance, less common in collection and apparently more restricted to the south and middle eastern United States, which has also been labelled as *S. eboracensis*; however its genitalia shows that it is an undescribed species related to *S. ochristriata* (which is generically distinct from the *basilaris-eboracensis* group). It has been reared repeatedly from thistle (*Cirsium sp.*, Compositae). Its adults do not have the thick anal brush, long tibial brushes and thick antennae characteristic of *S. eboracensis* . The specimen illustrated as *S. eboracensis* on Fig. 1 of plate 2 in Hodges (1978) is misidentified and actually represents the undescribed, thistle-feeding species. Records in Forbes (1923: 350) and Covell (1984: 438) of *S. eboracensis* as feeding on thistle heads are also based on misidentifications.

Recognition. — Adults are medium to medium-small scythridids with upper surface of the body uniformly very dark brown with some purplish hue, the proximal 2/3 or 3/4 of flagellum distinctly thickened (Figs. 18, 91), very long, prominent hind tibial brush and, in males, dense anal tufts. Seen with the naked eye, many specimens appear to have ebony-black, slightly lustrous forewings. In color, size and hind tibial brushes, they closely resemble adults of a related, undescribed species. Members of these two species superficially resemble in color and size those of a few undescribed species, notably one of the *ochristriata* group (see "Notes about synonymy and identity" above), but are readily distinguished from all other North American scythridids, except the related *S. basilaris* , by aspect of the male and female genitalia. They are distinguished from those of *S. basilaris* by their uniformly dark brown forewings, in the males by the latero-posterior processes of S8 which are distinctly shorter than the combined length of the medial portion and anterior apodemes (Fig. 209), and in the females by the very shallowly emarginate S7, the narrow, tubular, straight and apically subtruncate sterigma (Fig. 319), and the pear-shaped bursa (Fig. 380).

Description. — Size. Forewing length 4.3-6.2 mm (mean = 5.5); hindwing length 4.1-5.5 mm (mean= 4.9); wing expanse 9.7-13.6 mm (mean = 12.3)(15 specimens).

Head. Face and neck tufts in most specimens dark fuscous brown with purplish or golden metallic hue, in some specimens olive-brown mixed with drab. Eye as in*S. basilaris* . Haustellum base with drab and olive-brown scales. Maxillary palpi as in *S. basilaris* . Labial palpi relatively short, porrect or upcurved and extended to base of antenna; article 1 and basal half of article 2 dirty white, distal half of article 2 and article 3 colored as face. Antenna colored as face, extended to two-thirds to three-quarters of forewing length, moniliform; proximal two-thirds to three-quarters distinctly thickened; ventral surface in males densely ciliate, in females scatteringly so; scape as in *S. basilaris* .

Thorax. Dorsal surface colored as face with marked purplish or golden metallic hue; in several specimens collar and tegulae with golden hue, mesoscutum and mesoscutellum with purplish hue. Ventral surface grey or pale olive-brown with slight iridescent hue. Legs olive-brown or grey-brown.

Wings. Structured and veined as in *S. basilaris* . Forewing upper surface colored as in *S. eboracensis* ; ventral surface in males olive-brown or drak grey, in female mostly cream-color or yellowish with dense drab, greyish or olive-brown scaling in disc area. Hindwing upper surface as in *S. eboracensis* ; ventral surface colored as that of forewing.

Abdomen. In males dorsal surface colored as mesoscutum; ventral surface dark grey-brown, in several specimens S4-S6 medially somewhat paler. In females, dorsal surface with ground color as that of mesoscutum, densely mottled with yellowish or dirty cream-color; ventral surface on anterior half and laterally drab or olive-brown, medially and on distal half cream-color or dirty yellowish. Terga and sterna as in *S. basilaris* except S7 of female with caudal margin very shallowly emarginate and inner fold broad and extended to over half length of sternum (Fig. 319).

Male genitalia. S8 (Fig. 209) as in *S. basilaris* except as follow: anterior apodemes parallel or convergent, shorter than medial transverse portion, medial portion in some specimens broad and trapezoid or subquadrate, in some specimens transverse; latero-posterior processes distinctly shorter than combined length of medial portion and anterior apodemes, in some specimens apcially incurved, in some specimens straight.

Female genitalia as in *S. basilaris* except as follow: S8 indistinctly sclerotized, elongate-subtrapezoid, with cluster of few setae at latero-posterior angle. Stergima narrow, tubular, straight, distally very slightly tapered, apex broader, subtruncate (Fig. 319). Corpus bursae moderately elongate, ± pear-shaped (Fig. 380).

Variation. — Little variation was observed in color and external appearance of specimens examined. Slight differences in color indicated in the description are possibly the result of differences in age of specimens in collections: older specimens tend to be paler, more fuscous brown (probably somewhat faded) whereas recently collected ones are almost black. One male specimen from Texas is almost entirely grey with brassy hue but this seems to be its real color because the specimen is not worn. In male genitalia, the median portion of S8 varies from about subquadrate or subtrapezoid to distinctly transverse, the latero-posterior apodemes from incurved to straight and parallel, and the distance between the anterior apodemes from distinctly less than, to almost as wide as, the the maximum width of the sternum.

Phylogenetic relationships. — Closely related to *S. basilaris* .

Geographical distribution and period of flight. — Known to range in eastern North America, north to southern Manitoba, west to central Texas and Manitoba, south toFlorida (Fig. 422). Most records are from the southeastern United States.

In the southern part of the range, seasonal records suggest that the species is bivoltine: adults occur from mid-April to mid-May (Texas, Florida) or mid-May to late June (middle part of range), and from mid- or late August to September (later records in mid-October in Florida). In the northernmost part of the range (Manitoba, Nova Scotia), adults were collected in late June and early July, suggesting a single generation. Two adults were collected at flowers in mid-December in Washington D.C.! Mating has been observed in mid-September in Mississippi (R.L. Brown, pers. comm. 1985). Adults are diurnal and frequent flowers; they have been found on *Eupatorium perfoliatum* (Compositae), *Helenium americanum* (Compositae), and on blackberry (Rosaceae). They have also been collected by sweeping alfalfa (South Dakota) and in Malaise traps (Florida, Kentucky, Arkansas).

Hostplant. — Unknown.

3.3.13 *Scythris interrupta* Braun

(Figs. 20, 153, 210-212, 320-321, 381, 415)

Scythris interrupta Braun, 1920: 41. —McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist].

Type material examined. — HOLOTYPE male in ANSP, labelled: "City Cr. Canon/ Highlands, Cal./ v.11.13." [handwritten]; "TYPE/ Collection of/ Annette F. Braun." [red, printed]; "Scythris/ interrupta/ Type Braun." [white with black-lined top and bottom margins, handwritten]; "[male symbol] genitalia on/ slide no./ JFL-85-0271/ by J.F. Landry/ ANSP coll." [green, partly printed, partly handwritten, added by me]; "ANSP" [pale yellow, printed, two back to back]. Abdomen and genitalia dissected and mounted on slide no. JFL-85-0271.

PARATYPES, three males and four females (ANSP), with same collecting data as holotype. They bear a red label marked "Paratype" in Braun's handwriting. One male bears two additional labels: 1) "Scythris/ interrupta/ Paratype Braun" [white with upper and lower margins black, in Braun's handwriting]; 2) "PARATYPE/ Scythris/ interrupta/ Braun" [blue, not Braun's original].

Type locality. — City Creek Canyon, Highlands [*sic*], California, as given by Braun (probably in or near Highland, San Bernardino Co., Calif.).

Recognition. — Adults are medium-small scythridids with dark brown forewings with a straight longitudinal white streak in fold extended to about middle of wing length and a distal white spot in fold, giving the appearance that the streak is interrupted (Fig. 20). A somewhat similar color pattern is present in an undescribed and unrelated species from the Southwest and Mexico but in the latter, apex of the longitudinal streak is interrupted by a short, transverse streak. Some specimens of *S. trivinctella* and *S. impositella* also have a streak or elongate spot in the basal half of forewing and a distal spot, reminding of the pattern of *S. interrupta* , but in those proximal portion of the streak is behind the fold near the hind margin and is somewhat curved or oblique.

Adults of *S. interrupta* are best distinguished from those of all other Nearctic scythridids by features of the genitalia. Males (Figs. 210-211) have a subcylindrical tegumen encasing a bottle-shaped aedeagus, an elongate, apically slit juxta appressed ventrally against the aedeagus and tegumen, and parallel, rod-like valvae fused to the vinculum in a position laterad of the tegumen and with a dense subapical tuft of stiff setae. Females (Fig. 321) have a relatively small, subconical sterigma and the distal portion of the ductus bursae is sclerotized and irregularly twisted.

Description. —Size. Forewing length 4.7-5.3 mm (mean = 4.9); hindwing length 3.9-4.5 mm (mean= 4.2); wing expanse 10.4-11.7 mm (mean = 10.8)(5 specimens).

Head. Face brown, clypeal area drab or greyish with, slightly lighter suffusion in some specimens. Neck tufts brown with base behind eye whitish. Eye relatively small, distinctly narrower than frons. Haustellum base with light brown, drab or light gray scales. Maxillary palpi conspicuous, folded over base of haustellum, whitish. Labial palpi short, extended to level of frons; article 1 white, articles 2 and 3 buff or brown, dorsally suffused with whitish. Antennae relatively short, extended to middle of forewings, brown or olive-brown; in males, cilia distinct, dense.

Thorax. Dorsal surface brown or grey-brown, collar and tegulae with light golden metallic hue. Ventral surface whitish to light drab suffused with whitish, area below base of forewing darker, greyish-drab or light buff. Legs greyish, whitish-grey or grey-brown suffused with whitish.

Wings. Forewing elongate-lanceolate (Fig. 153); dorsal surface dark brown or grey-brown, fold with straight, longitudianl, distally slightly widened white streak extended to almost middle of wing, and with irregular white spot near termen; ventral surface brownish in males, whitish buff in females; cilia brown or grey-brown. Venation as in *S. limbella* . Hindwing elongate-lanceolate, , hind margin almost straight; dorsal surface uniformly dark brown; ventral surface as in forewing; cilia dark brown. Venation (Fig. 153) as in *S. limbella* , except as follow: Sc+R1 interrupted at or indistinct beyond middle of costa, M2 and M3 connate (or either one absent), CuP indistinct. Female frenulum with two bristles.

Abdomen. In males, dorsal surface uniformly grey-brown; in females, dorsal surface with distinct iridescent hue, basal half medially dark brown, laterally paler rufous brown, distal half grey-brown with distal portion of each tergum lighter. In both sexes, ventral surface dirty white. Terga and sterna (as seen in potash-cleared specimens) distinctly sclerotized. In males, T2 margined anteriorly and laterally, T3-T7 margined anteriorly; T8 unmargined, unmodified, small, quadrate; S7 indistincly margined anteriorly, other sterna unmargined; S8 (Fig. 212) subtriangular, laterally broadly rounded, medio-distally protruded into apically bifurcate projection. In females, terga and sterna margined as in males; T2-T6 transverse, T7 elongate trapezoid; S2-S6 transverse; S7 (Fig. 320) subquadrate, posterior margin V-emarginate, with semi-circular flap folded inwardly against internal wall of sclerite, distal two-third of sclerite with two broad, suborbicular, smooth, unscaled areas (visible also on dry specimens).

Male genitalia (Figs. 210-211). Symmetrical. Tegumen elongate, subcylindrical in lateral aspect (Fig. 210), about three-quarter length of genitalia, encapsulating aedeagus, apical portion abruptly bent ventrad at 90° angle; anterior margin with moderately deep quadrate emargination; in dorsal aspect, distal half laterally dilated. Uncus (?), two small digitate, setose lobes fused to apical margin of tegumen (Fig. 211). Gnathos absent. Vinculum transverse, ventrally directed plate, wider than tegumen, perpendicular to rest of genitalia, medially convex. Valvae two straight, parallel rods rigidly fused to vinculum in position laterad of tegumen; inner side of subapical portion obliquely flattened, with inwardly oriented tuft of dense, stiff setae (Fig. 211). Juxta medial, distally dilated and apically slit projection almost as long as and closely abutted to tegumen (Fig. 211). Aedeagus encased by tegumen, bottle-shaped, quite large, distal half tapered and bent ventrad, apex at level of uncus; base with rudder-like, ventrally oriented projection. Bulbus ejaculatorius about size of aedeagus, slightly elongate, bulbous sac; right side with short extension.

Female genitalia (Figs. 321, 381). S8 narrowly elongate, posterior margin with two or three fine setae at lateral angles, distal half of sclerite with slightly corrugated surface. Sterigma situated at anterior margin of S8; in dorsal aspect a small, short conical projection; in lateral aspect, distal half of projection above surface of S8, swollen. Ostium at apex of sterigma, pointed caudad. Ductus bursae very slightly sclerotized in posterior half; distal portion nearly straight, medial portion with 2-4 irregular coils; inception into corpus bursae in posterior portion of bursa. Corpus bursae (Fig. 381) elongate, probably subcylindrical with dilated anterior end (bursa could not be fully inflated in specimens examined). Spermatheca bulbous with tapered anterior apex, duct finely coiled. Apophyses thin, straight, anterior ones slightly divergent, longer than S8, posterior ones about twice length of anterior ones. Ovipositor about twice length of S8, papillae anaes membranous.

Variation. — No significant variation is present in the type material. Some specimens have the distal third of forewing lightly suffused with white and light buff scales, whereas it is concolorous brown or grey-brown in others. In one specimen the distal spot is indistinct.

Phylogenetic relationships. — Probably related to the *S. basilaris* complex based on similar and probably apomorphic structure of male genitalia. In male genitalia the tegumen is capsular and encloses the aedeagus, the uncus is similarly fused and bilobate, the gnathos is absent, the juxta is similarly shaped and positioned, and the valvae are straight rods with apical setae and are similarly fused to the vinculum.

Geographical distribution and period of flight. — This species is known only from the type locality (Fig. 415) and type material, which was collected in May.

Hostplant. — Unknown.

3.3.14 *Scythris inspersella* (Hübner)

(Figs. 8, 231-215, 324-325, 382, 409)

Tinea inspersella Hübner, [1817], plate 66, fig. 443.

Butalis inspersella ; Zeller, 1855: 252 [redescription].— Walker, 1864: * [descriptive catalogue].— Staudinger and Wocke, 1871: 323 [catalogue].

Scythris inspersella ; Spuler, 1910: 440 [faunal work].— Lhomme, 1949: 804 [catalogue].— Leraut, 1980: 73 [checklist].— Sattler, 1981: 13 [notes about distribution and natural history].— Bengtsson, 1984: 52 [faunal work].

Gelechia aterrimella Walker, 1864: 590. **Tentative new synonymy.**

Butalis aterrimella ; Walsingham, 1888: 115 [redescription from a possible misidentification].— Smith, 1891: 107 [checklist].

Scythris aterrimella ; Dyar, 1902: 537 [catalogue].— Smith, 1903: 117 [checklist].— Barnes and McDunnough, 1917: 190 [checklist].— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist].

Scythris hypotricha de Joannis, 1920: 145 [synonymized by ?].— Lhomme, 1949: 804 [catalogue].— Passerin d'Entrèves, 1976: 41 [notes about type material].— Leraut, 1980: 73 [checklist, as a synonym of *S. inspersella*].— Bengtsson, 1984: 52 [faunal work, as a synonym of *S. inspersella*].

Scythris epilobiella McDunnough, 1942: 224.— Hodges *et al.*, 1983: 19 [checklist]. **New synonymy.**

Notes about synonymy. — *G. aterrimella* : Walker described the color of *S. aterrimella* as "deep black", whereas *S. inspersella* is blackish with scattered white scales on the forewings. Walsingham (1888: 115) redescribed *S. aterrimella* from "fresh specimens" that he regarded as conspecific with the type. The need for that redescription implies that Walker's type is probably worn and that Walker's description of the coloration is thus inadequate. Walsingham redescribed the species as having scattered white scales on the forewings, adding that these scales "appear very fugitive, and in a worn specimen are almost entirely removed". I have examined and dissected the genitalia of one of Walsingham's specimens, a male from Mt. Shasta, Siskiyou Co., California (USNM), and regard it as conspecific with *S. inspersella*. Hence if Walsingham's specimens were also conspecific with the type of *S. aterrimella* , the latter would be conspecific with *S. inspersella* but the name of the former would be a junior synonym. However since Walsingham did not examine the genitalia of the type of *S. aterrimella*, I await its study before taking formal nomenclatural action. The type locality of *S. aterrimella* is situated relatively close to where adults of *S. inspersella* were collected in northern Ontario, a region of uniform boreal forest habitat.

Scythris hypotricha : the conspecificity of this nominal species with *S. inspersella* was first indicated by Leraut (1980: 73) who did not mention whether he was the original author to propose it. Passerin d'Entrèves (1976) illustrated the genitalia of the female holotype without mentioning a possible synonymy with *S. inspersella* , but the conspecificity is obvious from his illustration alone. This was confirmed by Passerin d'Entrèves (pers. comm. 1983)

Type material. — *Tinea inspersella* : type material probably lost (Sattler 1981).

Gelechia aterrimella : type material in BMNH and not examined. According to Walsingham (1888: 115), it comprises only a male holotype.

Scythris hypotricha : HOLOTYPE female in MHNP, studied by Passerin d'Entrèves (1976), who dissected and illustrated its genitalia.

Scythris epilobiella : HOLOTYPE examined, male in CNC, labelled: "Alberton, P.E.I./ 2-viii-1940/ J. McDunnough"; "Bred from/ fireweed"; "HoloTYPE/ Scythris/ epilobiella/ No

5270 McD" [red, handwritten]; "Return to/ C.N.C." [red, printed]. The specimen is not dissected. ALLOTYPE female, with same data as the holotype (CNC). PARATYPES, nine males and five females: four males and five females with same data as holotype except date: two males, 2.viii.1940 (CNC); one male, 3.viii.1940 (USNM); one male, two females, 4.viii.1940 (CNC); one female, 5.viii.1940 (CNC); two females, 7.viii.1940 (one in CNC, one in USNM); five males: Eel River, New Brunswick, 26.vii.1941, T.N. Freeman, host = fireweed (four in CNC, one in MCZ).

Type localities. — *Tinea inspersella* : unknown, but the species was observed by Hübner in the vicinity of Augsburg, West Germany (Sattler 1981).

G. aterrimella : The original citation of the type locality (Walker, *loc. cit.*) is "St.Martin's Falls, Albany River, Hudson's Bay"; this is undoubtedly the same as Marten Falls (Indian Reserve), Cochrane District, Ontario (situated on the Albany River in northern Ontario).

S. hypotricha : Saint-Saëns, Seine-Maritime, France.

S. epilobiella : Alberton, Prince Edward Island.

Recognition. — Adults are medium-large scythridids with very dark, blackish upper surface of body (actually scales are dark brown or dark olive-brown under magnification but appear black with the naked eye), and upper surface of forewings with scattered white suffusion (Fig. 8); in some specimens white scales form one or two small, indistinct dots on disc. The ground color resembles the dark, ebony-like coloration of adults of *S. eboracensis* but adults of *S. inspersella* are larger, have more slender wings and legs, and lack the marked purplish hue of *S. eboracensis* specimens. Specimens of *S. inspersella* can be readily distinguished from those of all other North American scythridids by features of male and female genitalia. In males (Figs. 213-214), the tegumen bears two large lateral processes, the right one being long and clavate, the valvae are apically prong-like, have a costal prong-like projection and are fused distally by a transverse bridge, and the long, narrow, tubular aedeagus is ankylosed by a large juxta with a ventrally protruded apophysis. In females (Figs. 324-325), the sterigma is a large, dilated projection with apex like that of an elephant proboscis.

Description. — Size. Forewing length 6.1-7.5 mm (mean = 6.8); hindwing length 5.4-6.4 mm (mean= 5.9); wing expanse 13.5-16.3 mm (mean = 15.0)(16 specimens).

Head. Face and neck tufts dark brown, dark olive-brown or blackish-brown, with metallic lustre and faint greenish, bluish or purplish hue; clypeal area with few white scales in most specimens. Eye moderately large, convex, narrower than frons. Haustellum base clothed with scales colored as face and with scattered white scales. Maxillary palpi very small, inconspicuous, of four articles. Labial palpi upcurved, extended to, or almost to, level of vertex; article 1 short, recessed, drab suffused with whitish, articles 2 and 3 colored as face, variously suffused with white. Antenna filiform, extended to two-thirds of forewing length, dorsally colored as face, ventrally with scaterred whitish or gray scales; ventral surface densely ciliate in males, less so in females; scape baso-ventrally with inconspicuous pecten of two or three fine, hair-like scales.

Thorax. Dorsal surface colored as face, in some specimens with very scattered white suffusion. Ventral surface paler, drab with marked metallic lustre and light golden hue. Legs greyish, drab or pale olive-brown, scatteringly to densely suffused with white.

Wings. Frenum present. Forewing elongate-lanceolate, apex acute, termen sinuate; upper surface with ground color as face, base of many dark scales drab; in some specimens distal half of wing almost greyish-drab; surface very scatteringly suffused with white, in some specimens white scales forming one or two small, ± distinct dots on disc; in most specimens with indistinct dark spot on disc at one-third just distad of white dot and at two-third; ventral surface drab-brown or grey-brown; cilia drab-brown or pale olive-brown. Hindwing upper surface brownish-drab or brown, with metallic lustre and light greenish or purplish hue; ventral surface colored as that of forewing; cilia drab or pale olive-brown. Venation as in *S. limbella* except as follow: hindwing with M2 and M3 in most specimens separate; in some specimens M3 connate with either M2 or CuA1 or absent; female frenulum with two bristles.

Abdomen. In males, dorsal surface brownish-drab, brownish-grey or pale olive-brown, with light or marked golden, greenish or purplish metallic hue; ventral surface whitish except basally and laterally colored as, or densely suffused with same color as, dorsal surface. In females, dorsal surface dark olive-brown, dark brown or blackish-brown, with moderate to marked bluish or purplish metallic hue; ventral surface basally and laterally grey, greyish-brown or blackish-brown, medially and distally whitish or densely suffused with whitish, sternum 6 and sterigma yellowish. Abdomen (as seen in potash-cleared specimens) in males with terga anteriorly margined; T1-T2 distinctly sclerotized, T3-T7 with narrow, irregularly shaped area of distinct sclerotization medially, laterally nearly membranous; T8 (Fig. 215) markedly sclerotized, subcrescentic, antero-lateral angles prolonged into free apodemes as long as tergum, caudal margin narrowly bent inward; S1-S2 medio-anteriorly moderately sclerotized, S3-S7 membranous, S8 lightly sclerotized, small, narrowly transversely rectangular; in females, T1-T6 as in males, S1-S6 moderately sclerotized.

Male genitalia (Figs. 213-214). Tegumen strikingly asymmetrical, arch-like in anterior aspect, right side narrow, with thick, elongate, curved, clavate process extended above basal half of right valva; left side about twice as wide as right one, with broad, thick, truncate process extended partly over base of uncus. Uncus absent. Socii large, asymmetrically bilobate, right lobe about twice length of left one, lobes ventrally setose. Gnathos absent. Vinculum indistinct, markedly reduced to narrow, transverse band fused to base of valvae. Valvae fused basally and in distal third by transverse bridge; asymmetrical, apex pointed, upcurved, prong-like, finely setose; costa in basal half with prong-like process with heavily sclerotized distal portion and small, antero-basal tooth; costal process of right valva about twice size of left one. Juxta markedly developed, attached to base of vinculum-valvae and to anterior apex of aedeagus; fork-like with ventral apophysis in lateral aspect, extended cephalad of genitalia. Aedeagus antero-ventrally ankylosed, slender, tubular, slightly longer than genitalia, basal third ventrally dilated, distal third curved leftward; proximal half extended cephalad of genitalia; axis oblique to right side, apical portion extended between right process of tegumen and right lobe of uncus. Bulbus ejaculatorius compressed, subconical, with curved projection on open side.

Female genitalia (Figs. 324-325, 382). T7 elongate-rectangular, convex, well sclerotized. S7 ± diamond-shaped, moderately sclerotized. Segment 8 membranous, except anterior margin of T8 narrowly sclerotized. Sterigma at anterior margin of S7, strikingly developed, markedly sclerotized, heavy, asymmetrical, ± proboscis-like, as long as T7, basally constricted, medially dilated, apical portion bent leftward and dorsad, apex broad and truncate. Ostium small, subapical and dorsal on sterigma. Ductus bursae membranous, ribbon-like, inception latero-medially on bursae (Fig. 382). Corpus bursae (Fig. 382) bean-shaped; ductus seminalis with origin laterally on distal third of bursa and subcontiguous to inception of ductus bursae, proximal portion very broad, distal portion narrowed. (Spermatheca not examined). Anterior apophyses short, about length of T8. Posterior apophyses very thin, about three times length of anterior ones. Ovipositor moderately long, about 0.3 length of T1-T7; papillae anales membranous.

Variation. —Little variation was seen in coloration of specimens examined. Amount of white suffusion on upper surface of forewings varied slightly from extremely scattered and inconspicuous to moderate and conspicuous. Darkest and least white-suffused specimens were from Mt. Shasta, California. In venation of hindwing, M3 is present and separate in most specimens, but in some specimens its base is very proximate to that of CuA1; in some specimens M3 is not present as a separate vein, being either absent or connate with either M2 or CuA1. In venation of forewing, M3+CuA1 is present; Bengtsson's (1984: 15, fig. 8) illustration of the venation shows M3+CuA1 absent and this may represent a rare variant. Genitalia of specimens from Mt. Shasta are indistinguishable from those of specimens from eastern North America and Europe despite the enormous (? apparent) distributional gap (see below).

Phylogenetic relationships. — Uncertain at present. The species is not related to *Scythris s. str.* The markedly elongate sterigma situated at anterior margin of S7, and proximate position of inception of ductus seminalis and ductus bursae laterally on the bursa suggest relationships to *S. noricella*.

Geographical distribution and period of flight. — Known from scattered records in eastern Canada, on Prince Edward Island, New Brunswick, southwestern Québec and northern Ontario, and from Mt. Shasta in northern California (Fig. 409). Uncorfirmed records from Maine and Ontario are from Walsingham (1888), based on the possibility that *S. aterrimella* is conspecific with *S. inspersella*. The apparent extensive distributional gap between northeastern populations and the isolated Mt. Shasta population may reflect lack of collecting.

Hostplant.— Larvae feed on fireweed, *Epilobium angustifolium* L.(Onagraceae) (McDunnough 1942, Sattler 1981, Bengtsson 1984). Lhomme (1949: 804) also reported *E. hirsutum* L., *E. montanum* L., *E. rosmarinifolium* Haencke and *E. spicatum* Lamk. as other hostplants used by larvae in France and Belgium. Specimens were recently reared from *Epilobium sp.* from Mt. Shasta, Siskiyou Co., California by J.A. Powell (UCB). Larvae occur gregariously in small groups and spin shoots and flower spikes of the hostplant with a loose web in which they feed (McDunnough 1942, Sattler 1981). Adults are diurnal and visit various flowers to feed (Sattler 1981).

3.3.15 *Scythris noricella* (Zeller)

(Figs. 55-56, 216-219, 322-323, 383-384, 408)

Oecophora noricella Zeller, 1843: 151.

Butalis noricella; Zeller, 1855: 248 [redescription].— Staudinger and Wocke, 1871: 323 [catalogue].

Scythris noricella ; Rebel, 1901: 183 [faunal work]. Lhomme, 1949: 803 [catalogue].— Wolff, 1964: 51 [faunal work].— Leraut, 1980: 73 [checklist].— Bengtsson, 1984: 53 [faunal work].

Scythris magnatella Busck, 1904: 768.— Barnes and McDunnough, 1917: 190 [checklist].— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist]. **New synonymy.**

Scythris noricella latifoliella Wolff, 1964: 51. **Tentative new synonymy.**

Notes about synonymy — The species is well known in Europe and recently has been finely illustrated in Bengtsson (1984). Although I did not examine the type material of *S. noricella,* I compared the type of *S. magnatella* with European specimens of *S. noricella.* The genitalia slide of the holotype of *S. magnatella* was prepared by Busck several years after he described the species; his note on the slide label, "= Scythris/ noricella/ Zell/ of Europe/ AB May 1927", indicates that Busck was aware that his nominal species was conspecific with *S. noricella* , but did not publish his observations.

The subspecies *S. n. latifoliella* Wolff from western Greenland was separated from the nominotypical form occurring in mainland Europe solely on account of its smaller size averaging "about 14.5 mm" as compared with an average of "18-19 mm [...] in wing expanse" in central Europe and northern Scandinavia (Wolff 1964). I do not regard this small size difference alone as sufficient criterion to warrant subspecies recognition, particularly in view of the fact that the small size of Greenland specimens is possibly the result of harsh climatic conditions and short summers stunting larval growth, hence resulting in smaller adults.

Type material examined. — *Oecophora noricella* : type material probably in BMNH and not examined.

Scythris magnatella : HOLOTYPE male in USNM, labelled: "22192" [written in lead pencil]; "Type/ No. 7884/ U.S.N.M." [red, printed, except number handwritten]; "Scythris/

magnatella/ Type Busck" [white with black border, handwritten]; "[male symbol] genitalia/ on slide/ AB May 7. 1927" [white with balck border, handwritten]; "ab 104" [pale green, typed, added by me for quick reference to Busck's scythrid slides]. The abdomen and genitalia were dissected by Busck and are on a slide labelled: "Scythris/ magnatella/ Type 7884 Busck/ on Epilobium/ B.C. Dyar 22192/ AB May 7 1927" [I encased the word "Type" in red]; "= Scythris/ noricella/ Zell/ of Europe/ AB May 1927". PARATYPE female labelled: "27188" [handwritten in ink]; "Scythris/ magnatella/ Cotype Busck" [white with black border, handwritten] (USNM). The specimen is without abdomen. A pupal skin is pinned under the specimen, indicating that it was reared.

Type locality. — *Oecophora noricella* : Steiermark region, southeastern Austria, probably in the vicinity of Mts. Schneeberg, Albel, Sonnenwendstein or Semmering (Zeller 1843: 151).

Scythris magnatella : Kaslo (on west shore of Kootenay Lake), Kootenay District , British Columbia.

Recognition. — Adults are large scythridids with upper surface of forewings brownish-grey suffused with white, and with one or two short dark streaks medially on disc and a small dark dot in apical third. In some specimens, white suffusion is denser between the discal streaks where it tends to form an indistinct white streak (Fig. 55). Some specimens from northern Canada are pale grey with scattered brownish suffusion and very indistinct dark markings. In size and ground color, adults of *S. noricella* somewhat resemble those of undescribed species occurring in the American southwest, but the latter are more extensively dark-streaked on forewings. Adults of *S. noricella* are distinguished from those of nearly all other Nearctic scythridids by features of male and female genitalia. In male genitalia, T8 (Fig. 216) is a narrowly elongate, thinly sclerotized flap, the valvae (Figs. 218-219) are medially fused over their basal half and have the apex characteristically sickle-shaped, and the aedeagus is arched and, with the juxta, extended cephalad of the genitalia. In female genitalia, the sterigma (Fig. 322) is a very long, narrow and slightly upcurved tube with the base anchor-shaped. The genitalia of *S. noricella* are similar to those of a closely related, undescribed species from the Pacific Northwest but, in males, differ in having valvae with the base laterally sinuate, the inner margin fused over the basal half and pre-apically abruptly sinuate (in the undescribed species, sides of valvae evenly curved, inner margin fused over only the basal quarter and pre-apically evenly curved); females of *S. noricella* differ in having the sterigma slightly upcurved with an anchor-shaped basal plate and the bursa oblong (Fig. 383) (in the undescribed species, sterigma markedly arched upward with a rounded basal plate and bursa bean-shaped). Adults of the undescribed species are also distinctly smaller and more darkly colored, with an indistinct whitish streak in basal half of fold of forewing.

Description. — Size (North American specimens). Forewing length 7.5-9.7 mm (mean = 8.8); hindwing length 5.9-8.1 mm (mean= 7.2); wing expanse 16.6-20.8 mm (mean = 18.8)(17 specimens).

Head. Face and neck tufts olive-brown or dark olive-brown; in some specimens with some drab or whitish suffusion; in few pale specimens, drab; with light metallic lustre and golden or purplish hue. Eye large, globulous, about as wide as frons. Haustellum base clothed with scales colored as face. Maxillary palpi very small, inconspicuous, not extended over base of hasutellum. Labial palpi upcurved, relatively long, extended to, or slightly beyond, level of vertex; article 1 pale, whitish in most specimens, in some specimens with some olive-brown; articles 2 and 3 colored as face, with some wwhite scales mostly at base and apex. Antenna filiform, extended to two-thirds of forewings, colored as face; ventral side densely ciliate in males, less so in females; scape baso-ventrally with pecten of few scales.

Thorax. Dorsal surface colored as face, in some specimens with few scattered whitish scales; in very few specimens with moderately dense ochreous or dirty white sufusion. Ventral surface drab or brownish-drab with pale golden metallic lustre. Legs colored as face, variously suffused with whitish, or paler drab with hind tibia mostly whitish.

Wings. Frenum present. Forewing elongate-lanceolate, apex acute, termen sinuate; upper surface in most specimens brownish-grey with very light purplish hue, distal half or two-thirds moderately suffused with white scales; in several specimens disc with two short, dark brown, ± distinct streaks medially behind fold separated by area of denser white suffusion, and with small dark brown dot in distal third; in few specimens, upper surface blackish olive-brown with rather dense white suffusion and ± distinct dark spot in distal third; in some specimens (mostly from northern Canada) upper surface pale greyish-drab with very scattered white suffusion, scatered brownish suffusion and without dark spots; ventral surface dull pale drab or drab; cilia drab with golden lustre. Hindwing elongate-lanceolate, apex acute, termen almost straight; both surfaces pale grey or drab with light metallic golden lustre and purplish hue; cilia colored as on forewing. Venation as in *S. limbella* except as follow: forewing with Sc to costa before middle, M1 very proximate to R4+5, M2 and M3+CuA1 forked; hindwing with Sc+R1 extended to costa far distally in apical quarter, M2 and M3 forked; female frenulum with two bristles.

Abdomen. In males dorsal surface brownish-grey, drab or very pale olive-brown, with light golden metallic lustre and light purplish, bluish or iridescent hue; T8 paler yellowish-drab, scales hair like, oriented ± obliquely from mid-line; ventral surface mostly whitish variously suffused with yellowish, drab or greyish, valvae mostly with yellowish scales. In females dorsal surface pale brownish-grey; ventral surface in some specimens whitish mixed with drab and yellowish; in some specimens olive-brown with whitish suffusion, sterigma whitish; in some specimens mostly yellowish-ochreous with some brownish or olive-brown suffusion. In males (as seen in potash-cleared specimens), terga lightly sclerotized, anteriorly margined; sterna unmargined, S1-S4 lightly sclerotized, S5-S7 lightly sclerotized antero-laterally, otherwise membranous, S7 very narrow. In females, T1-T6 lightly sclerotized, T2-T3 with fine anterior margin, T4-T6 unmargined; S1-S6 lightly to moderately sclerotized, unmargined.

Male genitalia (Figs. 216-219). T8 (Fig. 216) very elongate, narrow, flap-like, extended above genitalia, about length of T5-T7, medially almost membranous, laterally distinctly sclerotized, apex tapered, subpointed in some specimens. S8 (Fig. 217) as very narrow, transverse, warted band; in many specimens band medially interrupted. Tegumen in lateral aspect (Fig. 218) crescentic, convex, caudal margin bent ventrad; in dorsal aspect (Fig. 219) almost divided into two halves by wide, subquadrate or U-shaped emargination; in caudal aspect, caudal edge produced into short, truncate, medially notched flap (sclerotized intersegmental membrane between T8 and tegumen). Uncus absent. Socii divergent, flattened lobes pointed ventrally or cephalo-ventrally. Gnathos asymmetrical, very thin; proximal arms widely separated, extended cephalo-ventrally inside tegumen; right proximal arm abruptly curved leftward and arched transversely above distal portion of aedeagus, joined to left proximal arm leftward of aedeagus; distal arm somewhat sinuate, extended ventrad through cavity formed by vinculum ring. Vinculum fused to base of valvae, in ventral aspect as heavy ring extended cephalad of base of valvae. Valvae very long, about half length of abdomen and extended far caudad of rest of genitalia, basal half fused medially; basal third laterally sinuate, bulged; distal half narrowed, apical portion sickle-shaped, inner margin abruptly sinuate, apex acuminate; anterior edge medio-dorsally protruded into two small blunt processes; slightly caudad of processes with two small, V-shaped projections; costa densely, finely setose. Juxta markedly developed, articulated on antero-medial margin of vinculum ring and fused ventro-basally to aedeagus; in lateral aspect, comma-shaped, extended cephalad of genitalia. Aedeagus ankylosed, narrow, tubular, downcurved, apex subacuminate; in resting position, most of length extended cephalad of genitalia. Bulbus ejaculatorius small, digitate. Upper diaphragma sclerotized into wide arch extended above distal half of aedeagus.

Female genitalia. T7 elongate-rectangular, convex. S7 membranous. T8 (Fig. 323) narrowly elongate, well sclerotized, markedly convex, almost tubular with sides curved ventrad, caudal margin with few fine setae. S8 as membranous, narrow fold. Sterigma (Fig. 322) at anterior margin of S7, as strikingly elongate, slightly upcurved, irregularly wrinkled tube about half length of T1-T7; base anchor-shaped, with relatively narrow, oval opening. Ostium apical on sterigma, small. Ductus bursae very thin, membranous, inception on bursa as in *S. inspersella* . Corpus bursae (Fig. 383) elongate, subovoid, ± angulate; ductus seminalis as in *S. inspersella* . Spermatheca (Fig. 383) extremely long (longer than abdomen), thin, tubular, distal third with two swelled regions and with one or two loose coils near end. Anterior apophyses parallel, slightly shorter than T8. Posterior apophyses very thin, about 4 or 5x length of anterior ones. Ovipositor very long, about 0.6 length of T1-T7 (0.8 if segment 8 counted as part of it); papillae anales membranous.

Variation. — Most of North American specimens have the dorsal surface brownish-grey or greyish-brown with, on forewings, rather dense white suffusion, one or two very short, ± distinct dark discal streaks and a pre-apical dark dot (Fig. 55). Some specimens from the Yukon and Northwest Territories are very pale grey, and have forewings with scattered brownish suffusion and very indistinct streak and dot. Their ground color is similar to that of specimens of *S. noricella latifoliella* from Greenland as illustrated in Bengtsson (1984: 76). One specimen from southern British Columbia is very dark, almost blackish olive-brown with white suffusion (Fig. 56) and in coloration resembles very much specimens of *S. inspersella* . No significant variation was observed in genitalia.

Notes about structure of male genitalia. — Zander (1905) and Bengtsson (1984: 17) noted that the tergum and sternum of abdominal segment 8 were laterally fused together, thus forming a ring girdling the genitalia. However after examination of several male genitalia of specimens from various localities in North America and western Europe, I have been unable to confirm their observation. In specimens examined, the narrow transverse band formed by sternum 8 is medially very lightly sclerotized or interrupted, and the pleural area is distinctly membranous, with no trace of sclerotized connection between the tergum and sternum.

Bengtsson (1984: 53) also confused the uncus and gnathos in his description of the male genitalia. The structure described as "uncus bilobed, nodose" is probably the flap formed by the caudal margin of tegumen. This structure is actually the sclerotized intersegmental membrane between tergum 8 and tegumen, and is fused to the latter. Laterally this flap is extended cephalad along the dorsal emargination of tegumen. The antero-ventral margin of tergum 8 is attached to the caudal margin of the flap. I cannot recognize any structure that might represent a true uncus, and thus interpret the latter as absent.

The structure described by Bengtsson (*op. cit.*) as the gnathos is the bilobate uncus, and the true gnathos is not described. The complex course of the thin gnathos arms makes the structure difficult to recognize, and its interpretation requires rotation of the genitalia to see it fully and examination of the position of the anus. Morphologically the gnathos is attached to the caudal margin of tegumen and extended ventrad of the anus (Klots 1970: 119). In the male genitalia of *S. noricella* , the anus is situated on the left side of the genitalia at a point just above the junction of the two arms interpreted here as forming the basal part of the gnathos and ventrad of the socii.

Phylogenetic relationships. — Closely related to an undescribed species occurring in northern California, southern Oregon, Nevada and extreme south-central British Columbia. This small group does not belong to *Scythris s. str.*, but is possibly related to *S. inspersella* (see 'Phylogenetic relationships' under that species).

Geographical distribution and period of flight. — A Holarctic species with disjunct records probably as a result of collecting gaps. In North America (Fig. 408), known to occur mostly in the West, north to central Yukon and the Northwest Territories, south to northcentral Oregon and Colorado, the latter at higher elevations. In the East, known from a single locality in northeastern Québec. Also known from the west coast of Greenland (Wolff 1964). Undoubtedly more widely distributed on this continent as suggested by the commonness and wide distribution of its main hostplant, fireweed. In the Palearctic region, known to occur in northern Scandinavia, Belgium, the Alps, eastern-central Europe and in the Kamchatka peninsula of the far eastern USSR (Bengtsson 1984).

Bengtsson (1984: 54) reports that adults are attracted to light in Europe, but also that they occur "in gravel pits, along road-ways and similar places with high insolation" suggesting that they may also be active during the day. No data about daily period of activity are available for North American records. Adults have been collected from mid-July to early September, with most records obtained in August.

Hostplant. — Larvae feed on fireweed, *Epilobium angustifolium* L. (Onagraceae) (Zeller 1855: 250, Bengtsson 1984: 54), *E. rosmarinifolium* Haencke (Lhomme 1949: 803) and *E. latifolium* L. (de Lesse and Viette 1949, Wolff 1964). Larvae can be found together with those of *S. inspersella* on the same plants (Bengtsson 1984: 54). Busck (1904) reported that the larval foodplant of *S. magnatella* at the type locality was*Epilobium sp*.

The undescribed, closely related species mentioned above has been reared from *Eriogonum sulphureum* (Polygonaceae) in northern California and from *Eriogonum sp*. in southern British Columbia.

3.3.16 *Scythris piratica* Meyrick

(Figs. 328-330, 415)

Scythris piratiça Meyrick, 1928: 414.— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983:. 19 [checklist].

Type material examined. — Type material in BMNH and not examined. LECTOTYPE female designated by Clarke, 1965: 581. For notes about type material, see Clarke, *loc. cit.*

PARALECTOTYPE female (USNM) labelled as follow: "Mescalero/ New Mexico/ 7000' .10.27" [Meyrick's handwritten label]; "Comp. with type./ Scythris/ piratica/ Meyrick/ Det. J.F.G.C. 1948" [Clarke's label]; "Scythris/ piratica/ 3/3 Meyr./ E. Meyrick det./ in Meyrick

Coll." [Meyrick's label]; "Meyrick Coll./ B.M. 1938-290." [printed, upside down]; "[female symbol] genitalia on/ slide no./ JFL-85-0342/ by J.F. Landry/ USNM coll." [pale green, partly printed, partly handwritten, attached by me]; "Return to/ U.S. Nat. Mus." [yellow, printed, added by me]. Although not labelled as paralectotype, this specimen agrees with those listed by Meyrick in his original description and is probably part of the material that was subsequently given to Clarke by the BMNH following his work on the Meyrick types. The left forewing is broken off and in a gelatin capsule pinned under the specimen.

Type locality. — Mescalero, Otero Co., New Mexico ,7000 feet (elevation given by Meyrick).

Recognition. — The only adult specimen examined is a medium-small scythridid with brownish-grey forewings with basal and antero-median grey fasciae, upper surface of hindwings with a streak of indigo-black, iridescent scales along termen, and underside of fore- and hindwings with large areas of indigo-black, iridescent scales. The underside of hindwigs is covered with such black scales except for the veins which are a contrasting whitish. Similar in color pattern of wings to two undescribed, related species from California and Colorado (see 'Phylogenetic relationships' below). Because of insufficient material, it is not presently possible to establish firmly whether the undescribed specimens from California are specifically distinct or represent geographic variants of *S. piratica* . However color pattern of upper surface of forewings, under surface of hindwings iridescent black with whitish veins, and emargination of posterior margin of sternum 7 with two small, ampulla-like structures distinguish adults of *S. piratica* from those of other Nearctic scythridids.

Description. — The single female specimen examined is badly rubbed and in rather poor condition but it agrees well with Meyrick's (1928) description. Hence description of external features is not repeated here. I include only measurements and description of female abdomen and genitalia.

Size. Forewing length 5.4 mm; hindwing length 4.6 mm; wing expanse 12.0 mm (1 specimen).

Female abdomen. Terga and sterna 1-6 lightly sclerotized. S2 and S3 with small "fenestra" on each side near posterior margin. T3 distinctly margined anteriorly; T4-T6 indistinctly margined anteriorly. T7 and S7 distinctly sclerotized. T7 quadrate with posterior margin ventro-laterally produced into lobes. S7 (Fig. 328) subtrapezoid, posterior margin with deep, broad emargination and prolonged into inwardly bent flap; lateral angles produced caudad; inside of emargination with two small ampulla-like structures situated ventrad of ostium-sterigma (Fig. 329).

Female genitalia. T8 subquadrate, lightly sclerotized; latero-posterior angle with few fine setae. S8 subquadrate, almost membranous, medially lightly sclerotized. Sterigma (Fig. 330) small, subconical lamella post-vaginalis. Ostium situated at anterior margin of S8, small, pointed caudad. Ductus bursae fine, delicate, inception into corpus bursae seemingly on anterior portion of bursa. Corpus bursae delicate (shape undetermined, bursa could not be inflated on specimen examined); caudal end of bursa widened into ductus seminalis. (Spermatheca not examined). Anterior apophyses slightly sinuous, divergent, slightly longer than T8. Posterior apophyses thinner than, and about twice length of, anterior apophyses, inserted near anterior margin of T9+10. Ovipositor about twice length of T8; papillae anales membranous.

Variation. — Unknown.

Phylogenetic relationships. — Related to three undescribed species: one from Stanislaus Co., California, another from San Bernardino Co., California and a third from Mesa Verde National Park in southwestern Colorado. The small, double, ampulla-like invaginations on the caudal margin of sternum 7 of females are, as far as known, unique and hypothesized to be autapomorphic for the group. The undescribed species also share similar, probably apomorphic, structure of male genitalia with peculiar, scoop-shaped valvae; it is probable that males of *S. piratica* also share these features.

Geographical distribution and period of flight. — Known only from the type locality (Fig. 415) and type series. Specimens of the type series were collected from "August to October" (Meyrick, 1928: 414).

Hostplant. — Unknown. The two closely related species from central and south California have been reared from *Brickellia californica* (Compositae) (species from Stanislaus Co.) and *Malvastrum thurberi* (Malvaceae) (species from San Bernardino Co.).

3.3.17 *Scythris inornatella* (Chambers), new combination

(Figs. 224-225, 415)

Coleophora inornatella Chambers, 1879: 185.— Smith, 1891: 106 [checklist].— Dyar, 1902: 532 [catalogue]— Smith, 1903:116 [checklist].— McDunnough, 1939: 95 [checklist].— McDunnough, 1944: 237 [note about misplacement of species].— Hodges *et al.*, 1983: 17 [checklist, cited as misplaced].

Type material examined. — Type series in MCZ, consisting of two male syntypes.

LECTOTYPE male here designated, labelled: "Type/ 1591" [top white where the word "Type" is printed, rest of label red]; "Chambers/ Kentucky" [printed, with the word "Kentucky" crossed out]; "Coleophora inornatella/ Texas Chambers" [handwritten by Chambers]; "Slide BW 183 [male symbol] No." [pale green, partly handwritten, partly printed]; "LECTOTYPE" [red, printed, added by me]; "LECTOTYPE/ Coleophora/ inornatella/ Chambers/ Select. by J.F. Landry, 1985" [handwritten, white with red border]; "MCZ" [orange, typed].

PARALECTOTYPE male here designated: first three labels identical to those of the lectotype. Other labels are as follow: "Slide BW 184 [male symbol] No" [pale green, partly handwritten, partly printed]; "PARALECTOTYPE" [red, printed, added by me]; "PARALECTOTYPE/ Coleophora/ inornatella/ Chambers/ Select. by J.F. Landry, 1985" [white with red border, handwritten]; "MCZ" [orange, typed].

The abdomen and genitalia of both types were dissected and mounted on slides (no. BW 183 and BW 184). The original slide mounts were completely obscured by debris left inside the genitalia, so I remounted them after cleaning; the lectotype's abdomen is without the 7th and 8th segments.

The lectotype is without right wings, whereas the metathorax and hindwings of the paralectotype are broken off the body and hanging loose on the minuten; the paralectotype is without antennae and most legs.

Type locality. — Texas, as indicated by Chambers.

Recognition. — A small, buff-yellow scythridid with a broad, somewhat indistinct whitish streak in fold of the forewing. It is distinguished from all other Nearctic species by its compact male genitalia (Figs. 224-225) with a subspherical tegumen with darkly sclerotized, notched caudal margin, transluscent distal projection of gnathos and short, stubby valvae fused broadly at their base.

Description. — Based on the two type specimens which are rubbed and lack many appendages.

Size. Forewing length 4.3 mm; hindwing length 3.6 mm; wing expanse 9.5 mm (1 specimen).

Head. Face very light brown with light metallic reflection, whitish around eyes and at occiput. Eyes of moderate size, narrower than frons. Maxillary palpi indistinct in specimens examined (perhaps broken). Labial palpi white, relatively short, apex not extended to vertex. Haustellum base covered with white scales. Antenna buff, extended to about middle of wing.

Thorax. Dorsal surface whitish or light buff-yellow. Ventral surface mostly white or whitish. Legs buff to light brown.

Wings. Frenum present. Forewing upper surface buff-yellow with broad, somewhat indistinct white streak extended from base to termen at about 4/5 of wing length; ventral surface uniformly buff; cilia buff-yellow. Hindwing upper surface uniformly pale ochreous with light metallic reflection; ventral surface whitish; cilia buff. Venation not studied.

Abdomen. Color not examined as both available specimens were dissected. Terga almost membranous. Sterna very lightly sclerotized, margined anteriorly. S1-S3 subquadrate, S4-S7 transverse. Segment 8 apparently undeveloped (segments 7 and 8 lacking on lectotype, torn on paralectotype).

Male genitalia (Figs. 224-225) very compact. Tegumen (Fig. 224) subspherical; caudal margin darkly sclerotized and medially notched. Uncus absent. Gnathos basal paired arms fused to latero-caudal margin of tegumen; distal projection translucent, indistinct, projected caudad, slightly sinuate and longer than basal arms. Vinculum indistinct, fused to valvae (or lost). Valvae (Fig. 225) short, stubby, fused over basal half, inner margin medially with inwardly directed blunt tooth and apically with small blunt tooth. Aedeagus small, cylindrical, distally tapered.

Female genitalia unknown.

Variation. — The two specimens examined do not differ significantly.

Phylogenetic relationships. — McDunnough (1944: 237), upon examination of the type material, indicated that the species was misplaced in the Coleophoridae, but he did not re-assign it to another family. *C. inornatella* is unquestionably scythridid (as presently recognized), but its relationships to other Nearctic members of the family are unclear at present. The material at hand is in poor condition and females are unknown, thus preventing adequate assessement. It is not related to *Scythris s.str.* Phenetic similarity in male genitalia suggests that it is possibly related to *Apostibes euthia* Walsingham from Central America. That species, however, is not a true *Apostibes* (as defined after its type species *A. griseolineata* Walsingham, from Algeria) but belongs to an undescribed genus.

Geographical distribution and period of flight. — This species is known only from the type locality (Figs. 415). Collecting dates are unknown. The two syntypes are the only known specimens.

Hostplant. — Unknown.

3.3.18 *Scythris charon* Meyrick

(Figs. 21, 226-229, 421)

Scythris charon Meyrick, 1918: 156.— McDunnough, 1939: 91 [checklist].—Hodges *et al.*, 1983: 19 [checklist].

Type material examined. — LECTOTYPE male in BMNH, designated by Clarke, 1965: 573 and not examined. For notes about type material, see Clarke, *loc. cit.*

PARALECTOTYPES examined, two males in USNM labelled as follow:

Male 1: "Southern Pines/ N. Carolina/ P. .5.16/" [Meyrick's handwritten label]; "Comp. with type./ Scythris/ charon/ Meyrick/ Det. J.F.G.C. 1948" [Clarke's label]; "Scythris/ charon/

13/1 Meyr./ E. Meyrick det./ in Meyrick Coll." [Meyrick's label]; "Meyrick Coll./ B.M. 1938-290." [printed, upside down]; "[male symbol] genitalia on/ slide no./ JFL-83-1045/ by J.F. Landry/ in USNM coll." [green, printed except male symbol and number handwritten, added by me]; "Return to/ U.S. Nat. Mus." [yellow, printed, added by me].

Male 2: "Southern Pines/ N. Carolina/ P. .5.16/" [Meyrick's handwritten label]; "Scythris/ charon/ Paratype Meyr/ AB Jun 1932" [white, handwritten in blue by Busck, folded in two]; "Scythris/ charon/ Paratype Meyr" [white with black border, handwritten by Busck]. The first label is identical to that of male 1. Busck's label states that this is a 'paratype', suggesting that the specimen must have been part of the type series and sent to Busck by Meyrick (no later than 1932, as indicated on Busck's label). The specimen does not bear Clarke's label ("Comp. with type…") presumably because it was no longer in BMNH at the time of Clarke's extended visit there (which began in 1945). It is curious, however, that Clarke (*loc. cit.*) did not mention, as he usually did, that any of the 14 specimens indicated by Meyrick as forming the material upon which is based the description was missing. This would suggest that male 2 was not one of the original syntypes. However the similarity in label data with the paralectotype (male 1 above) and it being an authentic Meyrick specimen, as well as Busck's paratype indication indicate that it must have been part of the original type material and hence is a paralectotype [Article 74 (a)(iv) of the Code]. Meyrick did not designate types but Busck's paratype indication on a label also concurs to indicate that the specimen must have been part of the original series used by Meyrick to describe the species.

Type locality. — Southern Pines, Moore Co., North Carolina.

Recognition. — Adults are very small, dark brown scythridids with a distinctive, narrow white streak in fold of the forewing (Fig. 21). Adults of no other described species have the same external appearance, but a few undescribed ones, all occurring in western North America, have a similar, although broader or more diffused, white or ochreous streak in the forewing. Features of the male genitalia (Figs. 226-229), described below, readily distinguish *S. charon* from all other species except three closely related, undescribed ones which differ in color pattern of forewings.

Description. — Size. Forewing length 3.4 mm (2 specimens); hindwing length 2.9 mm (1 specimen); wing expanse 7.4 mm (1 specimen).

Head. Face mostly white, suffused with olive-brown scales on vertex; neck tuft mostly drab or olive-brown. Haustellum well developed, long; base with white scales. Maxillary palpus very reduced, of one article, subglobular (not visible unless scales removed from around). Labial palpus with basal half white, distal half with olive-brown scales mixed with few white scales; apex not quite reaching level of vertex. Antenna shorter than half length of forewing, with olive-brown scales except ventral surface of basal 1/4 with white scales.

Thorax. Dorsal surface olive-brown except laterally with white stripe from base of collar to tegula. Ventral surface white or whitish. Legs mostly whitish, suffused with olive-brown, more densely so on tarsi; cilia of hind leg olive-brown.

Wings. Forewing narrow, lanceolate; ground color of upper surface olive-brown, with narrow white streak in cubital fold from base to 4/5 of length (streak continuous with lateral stripe of mesothorax when wings folded) (Fig. 21); distal half suffused with white in some specimens; ventral surface uniformly pale fuscous or greyish brown; cilia olive-brown. Hindwing with upper surface unicolorous dark brown with slight metallic reflection; ventral surface paler, greyish-brown.

Male abdomen. Dorsal surface uniformly drab with marked iridescent hue; ventral surface whitish, sparsely suffused with buff or clay-colored scales. Tergites and sternites transverse, slightly sclerotized. T1 with posterior margin interrupted medially. T3-T7 indistinctly margined anteriorly. Sternites unmargined. S2 with well developed, slightly recurved and convergent anterior apodemes, without rods.

Male genitalia (Figs. 226-229). Mostly symmetrical. T8 (Figs. 228-229) markedly sclerotized, hood-like, subconical, shorter than tegumen, apex darkly melanized, attached to tegumen medially by sclerotized flap formed by intersegmental membrane T8-T9. S8 not developed. Tegumen (Figs. 226-227) markedly convex, longer than wide, lateral portions broad, anterior margin deeply V-emarginate; dorsum in lateral aspect (Fig. 226) markedly humped in proximal half; distal half lower, depressed, with dorso-lateral patch of short setae; pedunculus well developed, short, distinctly delineated by sinuation of ventro-caudal margin of tegumen; caudal margin laterally protruded into slightly asymmetrical, subtriangular flat lobes. Uncus fused to caudal margin of tegumen, indistinct as two lateral melanized patches around anus. Gnathos strikingly asymmetrical, fused to caudal margin of tegumen; ventrally a broad curved band bent around anus and projected dorsad on each side; left projection distally markedly sclerotized and darkly melanized, with coarsely microsculptured surface, apex with latero-anteriorly projected point; right projection smaller, subsigmoid, caudally oriented and tapered. Vinculum markedly reduced, indistinct. Valvae symmetrical, base fused into vertically oriented plate articulated to tegumen; valvae simple, rod-like, slightly curved, V-like in dorso-ventral aspect; costa in distal half with row of few straight, erect, relatively thick, hair-like scales. Aedeagus well developed, simple, tubular, distally slightly dilated with abruptly tapered short apex; base slightly curved and ankylosed (articulated) on transverse portion of fused valva base; apex positioned on right side of genitalia, adjacent to right projection of gnathos; bulbous ejaculatorius moderately enlarged to about size of T8.

Female abdomen and genitalia not studied (no females available for study).

Phylogenetic relationships. — *S. charon* and three other closely related, undescribed species are not members of *Scythris* in the strict sense but belong to an undescribed genus. The three undescribed species are respectively from Michigan, eastern Texas, and southcentral Colorado and southwestern Saskatchewan.

Geographical distribution and period of flight. — Known only from the type locality which is adjacent to the Weymouth Woods Sandhills in south central North Carolina (Fig. 421). Specimens of the undescribed species from Saskatchewan and Colorado were collected in the vicinity of sand dunes, as were those of the type series of *S. charon*. All three undescribed species are diurnal and were collected at flowers, by sweeping vegetation, or in Malaise traps (Texas specimens), suggesting similar habits for *S. charon* . Specimens of *S. charon* were collected in mid-May at the type locality.

Hostplant. — Unknown.

3.3.19 *Areniscythris brachypteris* Powell

(Figs. 24, 230-232, 331, 386, 415)

Areniscythris brachypteris Powell, 1976: 326. — Hodges *et al.*, 1983: 19 [checklist].

Type material. — HOLOTYPE male and ALLOTYPE female in CAS (on indefinite loan from the University of California, Berkeley) and not examined. PARATYPES, 103 males and females, in BMNH, CAS, CNC, LACM, UCB, UCD, UCR, and USNM. I have examined several paratypes from UCB, CAS, USNM and CNC collections. For detailed data about type material, see Powell, 1976: 327-328.

Type locality. — Dune Lakes, 3 airline miles south of Oceano, San Luis Obispo Co., California.

Recognition. — Adults are small to very small scythridids that are readily distinguished from all other Nearctic sycthridids by their reduced, stiff wings which are shorter than the abdomen, and their long, slender legs, especially the hind legs (combined hind tibia and tarsus as long as or longer than body) (Fig. 24). Adults of other undescribed, related species of sand dune scythridids have a somewhat similar appearance (Fig. 23) but have normal long wings and combined hind tibia and tarsus shorter than body.

Description. — For illustrations of habitus and wing venation, see Powell, 1976: 326-327, figs. 1-3 and p. 329, figs. 8-9). This is the only North American species of Scythrididae for which the genitalia of both sexes have been previously adequately illustrated. They are however redescribed here in greater detail. The larval stage has also been described and illustrated by Powell (*loc. cit.*).

Size. Body length 3.7- 6.1 mm (mean = 4.6) (5 specimens).

Face and neck tufts white, vertex olive-brown or drab suffused with some ochreous or tan. Occipital area extended behind eye as relatively wide, white-scaled band. Eye small, oval, less than half width of frons. Haustellum base with white scales. Maxillary palpi conspicuous, folded over base of haustellum. Labial palpi upcurved, short, almost extended to level of vertex, white, in most specimens article 3 with some olive-brown suffusion. Antenna whitish-grey, relatively thick, short, extended to about two-thirds of forewing length.

Thorax. Dorsal surface mostly white, or white with tan suffusion, or mostly tan, light brown or olive-brown with some whitish suffusion. Ventral surface white. Legs mostly white except tarsi mostly pale golden brown, very long and slender, combined hind tibia and tarsus as long as or longer than body; inner spurs of hind tibia very long; tarsal article 1-4 ventro-apically with very long, acuminate, spiniform white scales.

Wings. Frenum reduced. Forewing elongate-lanceolate, apex acute, membrane slightly sclerotized, melanized; upper surface, in palest specimens white or whitish with scattered duffuse linght brown or tan spots; in paler intermediate specimens, whitish with light tan streak on radius and on basal third near hind margin, and darker oblique streak in basal third, beyond middle and in distal quarter, defining white spots between them; darker intermediate specimens with olive-brown streak along hind margin from basal third to middle; in darkest specimens, surface predominantly olive-brown, with white costal streak and light tan subcostal area grading into olive-brown, disc with three ill-defined whitish spots in basal third, beyond middle and in distal quarter; ventral surface sparsely white-scaled; cilia reduced, white. Hindwing very narrowly elongate-lanceolate apex acute, both surfaces very sparsely white-scaled; female frenulum with two fine bristles.

Venation. Markedly reduced on both wings. Forewing with Sc basally developed; R stem developed, R branches obsolete except R5 to termen; with one M branch near margin; 1A+2A developed medially. Hindwing, in most specimens, with only portion of Rs and 1A+2A distinct.

Abdomen. Dorsal surface basally and laterally white, medially bariously suffused with tan, brownish and olive-brown. Ventral surface white. In males, terga and sterna (as seen in potash-cleared specimens) distinctly sclerotized, terga more so than sterna and anteriorly margined; T8 (Fig. 232) modified, elongate, tongue-like, extended above genitalia, anterior margin thick, antero-lateral angles produced into moderately heavy, anteriorly directed apodemes about half length of tergum; apodemes prolonged caudally on tergum as short rods. S8 unmodified, transverse, slightly smaller than S7. In females, terga and sterna distinctly sclerotized; T2-T6 narrowly margined anteriorly; T7 elongate-rectangular; S7 elongate, caudally tapered, posterior margin rounded.

Male genitalia (Figs. 230-231). Slightly asymmetrical. Tegumen subconical in dorsal aspect, moderately convex, slightly asymmetrical, anteriorly dorsally V-emarginate; lateral portion ventrally bent inward; in lateral aspect dorso-caudal portion concave. Uncus fused to tegumen, reduced, inconspicuous, as lobate process anteriorly delineated by dorsal, transverse patch of short setae. Gnathos asymmetrical; left basal arm fused to latero-caudal portion of tegumen, with heavily sclerotized, spine-like process recurved cephalad, with rough spinulate microsculpture; right basal arm fused to ventral side of uncus, with darkly sclerotized, thorn-like process projected caudad; distal arm sigmoid, attenuate, extended slightly beneath ventral level of genitalia. Vinculum reduced, fused to base of valvae as transverse, narrow rim, lateral portions outwardly protruded as crescentic flaps. Valvae with base broadly fused to one another and to vinculum, in form of transverse plate articulated to tegumen, plate dorso-laterally produced into lobes inside tegumen; valva simple, blade-like, inner side densely setose. Juxta seemingly absent. Aedeagus distally tapered, slightly curved rightward; base ankylosed between basal lobes of valvae; apex extended to the right of base of gnathos. Bulbus ejaculatorius smaller than genitalia, ± crescentic.

Female genitalia (Fig. 331). T8 with narrow anterior sclerotization, otherwise membranous, finely striulate. S8 mostly membranous, with two small, asymmetrical sclerites; right sclerite subtriangular, with some longitudinal wrinkles and jagged inner edge; left sclerite ± L-shaped, with some longitudinal wrinkles and jagged edges. Sterigma not developed (or constituted by L-shaped sclerite). Ostium very small, situated on anterior arm of L-sclerite at antero-lateral corner of S8, with very short and small antrum. Ductus bursae fine, inception at short distance caudad of bursa on ductus seminalis. Corpus bursae ovoid, much smaller than abdomen, caudally tapered into broad ductus seminalis. (Spermatheca not examined). Ductus spermathecae narrowly coiled. Anterior apophyses slightly divergent, slightly longer than T8, caudally prolonged on sides of T8 as thin rods. Posterior apophyses thinner than and about 1.5x lengh of anterior ones, insertion on sclerotized area of papillae. Ovipositor (Fig. 331) very short, about 0.15x length of T1-T7; papillae anales markedly striulate, laterally slightly sclerotized, apex deeply V-emarginate.

Variation. — The face and upper surface of the thorax and forewings vary from almost completely white with a few pale tan small spots in palest specimens, to predominantly drab or pale olive-brown variously suffused with white and pale tan in darkest specimens. In intermediately pale specimens, the forewings appear predominantly pale with two brownish, obliquely transverse bands in distal third. On forewings of intermediately darker specimens white scales form two elongate spots on distal half of disc separated by an obliquely transverse brown band.

Females with eggs have the abdomen distinctly extended beyond forewing apices, whereas it extends only slightly so in other individuals. Variation in genitalia was not examined.

Phylogenetic relationships. — Related to at least four other undescribed species of sand-dune inhabiting scythridids occurring in western North America. Adults of these other species that are in collections all possess long, functional wings, however, but form a monophyletic group with *A. brachypteris* based on apomorphic similarities in male genitalia, leg structure, scalation and life habits. An expanded definition of *Areniscythris* and discussion of its phylogenetic relationships to other scythridids are presented in chapter 4.

Geographical distribution and period of flight. — Endemic to the Santa Maria coastal dune system, southwestern San Luis Obispo Co. and northwestern Santa Barbara Co., California (Powell 1976) (Fig. 415). The period of flight of adults is remarkably long: Powell (1976) observed adults from late April to late August, and data about larvae suggested a single generation per year. The moths occur on open sand where they run and are active at mid-day mostly in sunny weather.

Hostplants. — Larvae have been observed feeding on various plants that can grow on the shifting sand of active dunes: *Phacelia distans* (Hydrophyllaceae), *Monardella crispa* (Labiatae), *Lupinus chamissonis* (Leguminosae), *Senecio blochmanae* (Compositae) and *Franseria* (*Ambrosia*) *bipinnatifida* (Compositae). They feed inside silken tubes spun on the surface of stems or leaves, which they skeletonize, and can be buried several centimeters deep by the shifting sand (Powell 1976).

3.3.20 *Scythris graminivorella* Braun

(Figs. 39, 233-235, 332-333, 387, 407)

Scythris graminivorella Braun, 1920: 40.— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist].

Type material examined. — HOLOTYPE male in ANSP, labelled: "B.1012" [white, handwritten]; "Cincinnati. O./ Annette F. Braun/ i.VI.6. 19" [white, partly printed, partly handwritten]; "TYPE/ Collection of/ Annette F. Braun" [red, printed]; "Scythris/ graminivorella/ Type Braun" [white with black top and bottom border, handwritten]; "ANSP" [pale yellow, printed]. The specimen is without abdomen.

PARATYPES, four males and five females (ANSP) with collection label and the small "B.1012" label same as that of holotype except for dates: one male "vi.4.19"; two males, one female "vi.5.19" (genitalia of one male on slide JFL-85-0272); one male "vi.6.19"; two females "vi.9.19" (genitalia of one specimen on slide JFL-85-0348); one female "vi.14.19" (right wings on slide JFL-85-0384); one female without the small "B.1012" label, "vi.15.13". All paratypes also bear an additional label: "Paratype" [red, in Braun's handwriting]; one female with date "vi.9.19" bears two more labels: "Scythris/ graminivorella/ Paratype Braun" [white with black-lined upper and lower borders, in Braun's handwriting]; "PARATYPE/ Scythris/ graminivorella/ Braun" [blue, partly printed, partly handwritten, not Braun's original]. Braun mentioned only eight in her original description. This could be a misprint because there is no doubt about the authenticity of the nine paratypes in ANSP.

Type locality. — Cincinnati, Hamilton Co, Ohio.

Recognition. — Adults are medium-small scythridids with upper surface dark brown or olive-brown with brassy lustre and, in most specimens, indistinct drab fasciae or streaks on the forewings (Fig. 39). In coloration they resemble specimens of *S. scintillifera* but the latter have a much brighter golden lustre and lack pale streaks. Features of male genitalia readily distinguish specimens of *S. graminivorella* from those of all other Nearctic scythridids (Figs. 233-235): the genitalia are very short and compact, with asymmetrical, stubby valvae and a large, strikingly coiled bulbus ejaculatorius that is much longer than the genitalia. Females are easily distinguished by the combination of a triangular, apically acuminate and bifid T7 and conical sterigma (Figs. 332-333).

Description. — Size. Forewing length 4.6-5.4 mm (mean = 5.0); hindwing length 4.0-4.7 mm (mean = 4.3); wing expanse 10.4-12.2 mm (mean = 11.2) (10 specimens).

Head. Face and neck tufts brown with faint or marked brassy lustre, in some specimens with faint purplish hue. Eye small, distinctly narrower than frons. Haustellum base clothed with brownish and whitish scales. Maxillary palpi very small, inconspicuous. Labial palpi short, extended to base of antennae, basally dirty white, distal portion of article 2 and article 3 brown lightly suffused with whitish. Antenna extended to about middle of wing, colored as face.

Thorax. Dorsal surface colored as face. Tegulae distally paler. Ventral surface dirty white or greyish with light metallic lustre. Meso- and metatrochanters whitish with brown distal spot. Legs whitish or drab to light brown, outer surface of tibiae and tarsi with brassy lustre.

Wings. Forewing elongate-lanceolate, apex acute, termen sinuate; upper surface greyish olive-brown or brown, with brassy lustre and very light greenish or purplish hue, and in most specimens with drab suffusion coalesced into indistinct fasciae or streaks: drab scales arranged as oblique streak or elongate spot across fold in basal third, some specimens with irregular distal fascia extended to apex; ventral surface in males grey-brown with brassy and reddish hue, in females dark brown with light iridescent hue; cilia brown with brassy hue. Hindwing narrowly elongate-lanceolate, hind margin slightly, evenly rounded; female frenulum with two bristles; upper surface in males brown with reddish or brassy hue, in females dark brown with light iridescent hue, darker in basal half along hind margin; ventral surface in males colored as that of forewing, in females colored as upper surface. Venation as in *S. scintillifera* except forewing with M2 and M3+CuA1 forked.

Abdomen. Upper surface in males colored as face, in females T1-T5 dark brown, markedly iridescent, T6 drab, T7 colored as face. Ventral surface in both sexes mostly whitish with light metallic lustre, baso-laterally drab. In males, terga (as seen in potash-cleared specimens) distinctly sclerotized, unmargined, gradually narrowed, T8 unmodified, elongate-rectangular, posterior margin rounded; S2-S7 membranous, S8 distinctly sclerotized, unmodified, transversely rectangular; S2-S3 latero-posteriorly with small fenestra. In females, terga and sterna 1-6 indistinctly sclerotized; T7 elongate-rectangular, distinctly sclerotized; S2-S3 latero-posteriorly with small fenestra; S7 (Fig. 332) most sclerotized, triangular, apex bifid, acuminate, ± pincer-like, margin folded inwardly, pre-apical portion medio-longitudinally grooved.

Male genitalia (Figs. 233-235). Short, blunt, very compact. Tegumen subhemispherical, slightly asymmetrical in dorsal aspect, dorsally convex; anterior margin roundly, shallowly emarginate; sides ventrally very widely incurved, partly closing tegumen cavity. Uncus very reduced, inconspicuous, fused to caudal margin of tegumen, as small setose area on right side of basal process of gnathos. Gnathos fused ot tegumen; basal process tooth-like, heavily sclerotized; left basal arm asymmetrically sigmoid, curved to the left and prolonged into distal arm; right basal arm inconspicuous; distal arm transluscent, thin, distal portion extended slightly caudad of left valva, apex abruptly dilated, ball-like, fuscous. Vinculum as reduced, narrow, transverse ridge fused with base of valvae. Valvae very short, stubby, asymmetrical; left valva larger than right one, incurved, apex heavily sclerotized, obliquely truncate, with fine setae; right valva shorter, subglobular, distally with heavily sclerotized inner tooth, apex rounded, setose. Aedeagus very short, about length of left valva, tubular, apically attenuate, oriented obliquely to the right, distal half abutted to inner side of right valva; latero-medially ankylosed on left side by flap (? juxta) attached to base of left valva. Bulbus ejaculatorius (Fig. 233) sausage-like, much longer than genitalia, coiled 3-4 times.

Female genitalia. T8 sclerotized anteriorly and laterally, horseshoe-shaped, membranous medial area with very fine longitudinal striulae. S8 membranous. Sterigma (Fig. 333) on membrane between S7 and S8, as markedly sclerotized, caudally projected narrow cone with antero-ventral edge produced cephalad. Ostium at apex of sterigma, very small. Ductus bursae very fine, membranous; inception on anterior third of bursa. Corpus bursae (Fig. 387) elongate, anterior third dilated, subovoid, distal two-thirds narrower, sausage-like, caudally narrowed into ductus seminalis. (Spermatheca not examined). Anterior apophyses about straight, moderately divergent, joined antero-laterally to T8. Posterior apophyses distinctly thinner, and about twice longer, than anterior ones. Ovipositor relatively short, about 0.2 length of T1-T7; papillae anales membranous.

Variation. — In most specimens the pale areas of forewings are very indistinct and present as a short oblique streak across the fold at midlength and as an ill-defined fascia or light suffusion in the distal third near termen. In some specimens with more conspicuous pale markings, drab scales form a broad, irregular pale fascia extended from the medial third of forewing to apex. In some darker specimens, there is only a short, inconspicuous streak at midlength and very scattered suffusion in distal third. Variation in male and female genitalia was not examined.

Phylogenetic relationships. — Related to *S. impositella* and *S. matutella*, based on the apomorphic S7 of females which is apically pincer-like. They belong to a group that includes several undescribed species and is generically distinct from and unrelated to *Scythris* in a strict sense.

Geographical distribution and period of flight. — Known to range in New Jersey, New York, Ohio, Indiana and Illinois (Fig. 407) and undoubtedly more widely distributed in the Northeast. Larvae collected in early May emerged as adults during the first half of June (Braun 1920), and adults were collected from mid-June to early July. The moths are probably diurnal.

Hostplant. — Part of the type series was reared from larvae that mined *Hystrix patula* (Gramineae). Also reared from *Lolium* sp. (Gramineae). Braun (1920) stated that she also observed mines on Canada blue grass, *Poa compressa* (Gramineae) but this record does not seem vouchered by specimens.

3.3.21 *Scythris matutella* (Clemens), status tentatively re-established

(Figs. 40-44, 236-239, 336-337, 388, 406)

Butalis matutella Clemens, 1860: 127.— Stainton, 1872: 40 and 127 [notes about synonymy *B. impositella*].— Zeller, 1873: 92 [notes about synonymy with *B. impositella*].— Chambers, 1874: 8 [notes about variation and natural history].— Chambers, 1878a: 93 [notes about variation] and 1878c: 133 [referenced list].— Walsingham, 1888: 113 [formal synonymy with *B. impoositella*].— Smith, 1891: 107 [checklist, as a synonym of *B. impositella*].

Scythris matutella ; Dyar, 1902: 538 [catalogue].— Barnes and McDunnough, 1917: 190 [checklist].— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist] [in all citations, as a synonym of *S. impositella*].

Sinoe ambroseaiella Chambers, 1873: 231.— Chambers, 1874: 9 [note about misidentification].— Braun, 1924a: 348 and 353 [note about misidentification]. ***Nomen nudum***.

Scythris winnella Busck, [no date]. Brower, 1984: 29. ***Nomen nudum*** .

Note about identity. — The reasons for tentatively re-establishing the status of this nominal species long considered as a synonym of *S. impositella* (Zeller) are discussed under the latter.

Notes about synonymy. — *Sinoe ambroseaiella* : First published mention of this name by Chambers (1873: 231) was:

> "SINOE, *gen. nov.*
>
> Generic characters as above and *ante v. 4, p. 192.* It is perhaps necessary here to advise some correspondents that specimens which they formerly received from me labelled *Sinoe ambroseaiella* — the name formerly attached to them in my cabinet before they were carefully examined — belong to a somewhat aberrant species of *Butalis (B. matutella*, Clem.) and are not congeneric with the species described below."

This clearly indicates that the name *Sinoe ambroseaiella* was first used as a label name for specimens later regarded by Chambers as *Butalis matutella* Clemens. Chambers (1874: 9) later stated: "I had at first inclined to erect for it a new genus, and specimens in my cabinet were labelled *Sinoe ambrosiaeella*, and have been distributed to some correspondents under that name." [note different spelling— see below]. The statement clearly implies that Chambers did not intend to make the name available, and it must be considered a *nomen nudum*.

Braun (1924a: 348 and 353) published a list of names written by Chambers to accompany specimens given by him to the American Entomological Society of Philadelphia. Braun added comments about several of those names, with the stated intent of elucidating Chambers' "conception of the species, unless there is obvious error or carelessness in labeling or his description forbids the assumption [about conception of the species]". The name *Sinoe ambrosiaeella* (note spelling different from Chambers' original) appears in that list (on p. 348) and is discussed briefly by Braun (p. 353) as follow:

"No. 18. *Sinoe ambrosiaeella* Chambers. The pill-box label gives the name as *Sinoe ambrosiaeella*, and the part of one hind wing and one fore wing shows that this specimen, as in the case of other specimens sent out by Chambers under that name, is *Scythris impositella* Zeller." Because *Sinoe ambroseaiella* Chambers is a *nomen nudum*, it is not available as a synonym.

In addition to the above, the specific epithet *ambroseaiella* first mentioned by Chambers (1873: 231) appears to be misspelled when compared to evidence external to the original publication. The spelling "*ambrosiaeella*" is used on the label attached by Chambers to the USNM specimen later marked as type (see below under "Type material examined") and by Chambers (1874: 9) and Braun (*loc. cit.*). However the original spelling *ambroseaiella* is to be considered correct [articles 32(b) and 32(c)(ii) of the Code].

Scythris winnella : this is a manuscript name inscribed on labels affixed by Busck to specimens (CNC, USNM), who obviously intended to describe the species.

Type material examined. — *Butalis matutella* : HOLOTYPE female in ANSP, labelled: "85" [small, pink, handwritten, placed on the minuten under the specimen]; "TYPE/ Butalis/ matutella/ B. Clemens/ 7479" [red, partly printed, partly handwritten, with number written across right side; label seemingly new, poss not original]; "Butalis/ matutella/ Clemens AB 1902/ Type" [folded in two, white with lower border thinly red-lined, handwritten]; "[female symbol] genitalia on/ slide no./ JFL-85-0279/ by J.F. Landry/ ANSP coll." [green, partly printed, partly handwritten, added by me]; "ANSP" [pale yellow, printed]. Abdomen and genitalia dissected and on slide no. JFL-85-0279.

Sinoe ambroseaiella : A female in USNM, labelled: "Sinoe/ Ch ambrosiaeella/ Cham." [white, in Chamber's handwriting; the letters "Ch" have been added (? later) by a seemingly different hand and are written across left side of the label; spelling of the specific epithet differs from that given in Chambers' original publication]; "Type/ No. 443/ U.S.N.M." [red, printed, except the number which is handwritten]; "Return to/ U.S. Nat. Mus." [yellow, printed, added by me]. I remounted the specimen on a new polyporous block. It is not clear who designated this specimen as type and affixed a red type label to it. Its status as a type is doubtful, particularly in view of Chambers' published statements about the name (see above under "Notes about synonymy").

Type localities. — *Butalis matutella* : not given by Clemens; probably Easton, Northampton Co., Pennsylvania (Hodges 1986: 36).

Recognition. — Adults are medium-small scythridids with the upper surface dark brown or olive-brown with marked brassy or cupreous lustre and with, in most specimens, two white or whitish transverse or oblique fasciae on forewings, one in basal third, the other in distal third (Figs. 40-42). A few specimens have a white plical streak instead of the proximal oblique fascia, and some lack fasciae and have uniformly dark wings. Specimens of *S. matutella* closely resemble those of the allied *S. impositella* , and many are indistinguishable in external aspect from the latter (compare Figs. 40-44 to Figs. 45-48). Fasciate specimens of *S. matutella* commonly have indistinct forewing fasciae, whereas the fasciae are sharp in most specimens of *S. impositella* examined. In features of genitalia however, adults of these two species are readily separable. Males of *S. matutella* have the distal arm of gnathos thin, transluscent, rod-like and straight (Fig. 236); in males of *S. impositella* , the arm is heavy, darkly sclerotized, curved, apically subclavate and armed with spines (Figs. 240, 243). Females of *S. matutella* have the sterigma cone short and blunt, and the pincer-like projections of the hind margin of sternum 7 relatively broad and blunt (Figs. 336-337); in females of *S. impositella* , the sterigma cone is elongate and subacuminate, and the pincer-like projections of sternum 7 are thin and pointed (Figs. 338-339).

Description. — Size. Forewing length 4.2-6.5 mm (mean = 5.2); hindwing length 3.6-5.6 mm (mean = 4.5); wing expanse 9.3-14.1 mm (mean = 11.5) (15 specimens).

Head. Face and neck tufts olive-brown, dark brown or grey-drab, with moderate or marked purplish, brassy, cupreous or golden metallic lustre. Eye medium, elongate-oval, markedly narrower than frons. Maxillary palpi very small, indistinct. Labial palpi short, porrect, or slightly upcurved and barely extended to base of scape; article 1 whitish, article 2 basally whitish mixed with drab, distally drab mixed with olive-brown, article 3 mostly olive-brown mixed with some drab. Antenna filiform, extended to slightly beyond middle of forewing, colored as face; scape without pecten; flagellum ventrally densely ciliate in both sexes.

Thorax. Dorsal surface colored and with same lustre as face, or greyish-brown, in many specimens collar, apex of tegulae and metascutum paler, grey or whitish. Ventral surface silvery-grey, or drab mixed with some whitish and with moderate brassy or golden lustre. Legs grey or grey-drab, with moderate golden or brassy lustre, or with proximal portion olive-brown mixed with drab and distal portions mostly dull whitish, or with femora whitish and rest of leg olive-brown mixed with drab and whitish.

Wings. Frenum present. Forewing elongate-lanceolate, apex acute, termen slightly sinuate; upper surface with ground color brown, olive-brown, or dark brown, with moderate or marked purplish, brasy, curpeous or golden metallic lustre; in most specimens with two whitish or yellowish fasciae (Fig. 40-44): proximal fascia just before middle obliquely extended on disc across fold, in many specimens somewhat elongate (Fig. 41), in several specimens irregularly rounded (Figs. 40, 44); distal fascia in distal third, extended transversely from middle of disc to hind margin; in few specimens, without proximal fascia and with plical streak extended from base to almost middle, and with small distal spot near termen in place of distal fascia; in many specimens, fasciae somewhat indistinct (Fig. 43); in some specimens, upper surface of immaculate ground color; ventral surface uniformly pale brown, drab or grey; cilia drab or olive-brown, with purplish and brassy lustre. Hindwing narrowly elongate-lanceolate, apex acute, hind margin almost straight; upper surface drab, grey or olive-brown, with slight golden, brassy or reddish lustre; ventral surface colored as that of forewing; cilia colored as those of forewing. Venation as in *S. limbella* except as follow: hindwing with Sc+R1 to costa before middle, M2 and M3 separate, CuA1 and CuA2 short near hind margin; female frenulum with two bristles.

Abdomen. In males, dorsal surface grey, grey-brown or drab, with moderate or marked pale golden or brassy metallic lustre and light iridescent hue; ventral surface with basal third or half grey-brown or drab, mixed with scattered white scales, distal half or two-thirds in most specimens white or whitish, in few specimens yellowish; terga moderately sclerotized, T3-T4 with anterior margin, other terga indistinctly margined or unmargined; T8 unmodified, in several specimens with anterior margin and antero-lateral angles prolonged into short apodemes; sterna moderately sclerotized, unmargined; S8 unmodified. In females, dorsal surface colored as in males or olive-brown, with same metallic lustre and hue as males; ventral surface with basal third grey-brown or olive-brown, medial sterna white, sternum 7 colored as basal ones; terga and sterna 1-6 moderately sclerotized, terga with fine anterior margin, sterna unmargined; segment 7 moderately sclerotized; T7 (Fig. 336) elongate-subrectangular; S7 ± trapezoid, posterior margin with broad, medial, oval emargination, sides of emargination caudally produced into pincer-like projections bracing sterigma.

Male genitalia (Figs. 236-239). Entire genitalia markedly asymmetrical. Tegumen markedly convex, in dorsal aspect (Fig. 238) asymmetrically subconical; sides reflexed ventrally, anterior and right lateral margins reflexed inwardly. Uncus fused to posterior margin or tegumen and to base of gnathos, as rounded, darkly sclerotized process. Gnathos (Fig. 236-238) markedly asymmetrical, skewed to left side of genitalia; left proximal arm fused along left side of caudal margin of tegumen, base produced into rounded, laterally compressed lobe with darkly sclerotized apical margin; right proximal arm narrow; distal arm bent at right angle and projected caudally, thin, rod-like, straight, transluscent or very lightly melanized, apex extended slightly beyond basal lobe of proximal left arm. Vinculum (Fig. 239) extended caudally beneath valvae, subquadrate, laterally indistinctly sclerotized, anterior margin medially protruced into small, saccus-like process. Valvae (Fig. 239) markedly asymmetrical, basally fused together and with vinculum; right valva larger than, and above plane of, left one (Fig. 236), apically dilated, subspatulate, curved inwardly, costal margin deeply emarginate from base to almost middle; left valva simple, blade-like, with fine scattered setae, costa basally with rounded process. Aedeagus ankylozed obliquely by stiff membrane, elongate, ± seringe-like with apex narrowly and abruptly tapered, directed rightward; baso-ventrally with elongate lamina (anellus ?) expanded distally into sheath covering right side of aedeagus; bulbus ejaculatorius (Fig. 239) greatly dilated, oval, about as large or larger than genitalia, right side with digitiform projection.

Female genitalia (Figs. 336-337). T8 elongate-rectangular, lightly sclerotized, posterior margin lined with fine setae; S8 (Fig. 337) membranous. Sterigma (Fig. 337) developed as heavily sclerotized, stubby, blunt cone projected ventrally and situated on intersegmental membrane between S7 and S8. Ostium at apex of sterigma, small. Ductus bursae narrow, wtih many short, loose coils, abruptly broadened near inception into bursa; inception at posterior of bursa. Corpus bursae (Fig. 388) spherical; ductus seminalis with origin at posterior end and proximate to insertion of ductus bursae, and with medial portion markedly dilated into ± pear-shaped sac (bursa thus appearing double). (Spermatheca not studied.) Anterior apophyses straight, parallel, slightly shorter than T7. Posterior apophyses thinner than, and about 1.5x length of, anterior ones. Ovipositor short, about 0.2x length of T1-T7, papillae anales membranous.

Variation. — Adults of *S. matutella* are quite varied in pattern of pale fasciae of the upper surface of forewings, and the variation observed seems to be somewhat geographically related. Most eastern specimens examined possess the two fasciae (Figs. 41-42), even though these are indistinct in many. In few eastern specimens the proximal fascia is replaced by a longitudinal streak in fold extended from base to one third or middle, and the distal fascia is reduced to a small spot near termen. Specimens from the mid-west and west have more or less rounded spots in place of elongate fasciae (Figs. 40, 44). All specimens seen from the Montréal area of southern Québec have uniformly dark metallic forewing upper surface (Fig. 43), with indistinct or no trace of pale spot or fasciae. Comparatively little variation was observed in several male genitalia examined: the shape and relative size of the bulbus ejaculatorius varies from cylindrical and about the size of tegumen to broadly oval or suborbicular and markedly larger than the whole genitalia. Variation in female genitalia was not examined.

Phylogenetic relationships. — *S. matutella* belongs to the same monophyletic group as *S. impositella* , *S. scintillifera* and *S. graminivorella* , which is defined by the apomorphic, pincer-like projections of sternum 7 of females.

Geographical distribution and period of flight. — Known to range mostly in eastern North America, from southern Ontario south to Texas and west to central Colorado and southernmost Saskatchewan (Fig. 406). Adults occur from mid-April (in the south) to mid-August, but are more common from late May to late June. Larvae have been found in mid- or late April and in late July - early August at the same locality in Ohio, suggesting that the species is possibly bivoltine in at least part of its range.

Hostplant. — Adults have been reared from larvae mining sunflowers (Compositae), *Helianthus sp.* in Ohio and *Helianthus stromosus* in southern Québec. The larva mining *H. stromosus* was found in early September and the adult emerged in mid-February. Some adult specimens from southern Québec (CNC) are labelled "on *Delphinium* " (Ranunculaceae) but without mention as to whether they were reared from such plants or merely found on them.

3.3.22 *Scythris impositella* (Zeller)

(Figs. 45-48, 86-88, 240-244, 338-339, 389, 405)

Butalis impositella Zeller, 1855: 241.— Stainton, 1872: 40 and 127 [notes about synonymy].— Zeller, 1873: 92 [notes about synonymy].— Chambers, 1878c: 133 [referenced list].— Walsingham, 1888: 113 [notes about synonymy].— Smith, 1891: 107 [checklist].

Scythris impositella ; Dyar, 1902: 538 [catalogue].— Smith, 1903: 117 [checklist].— Barnes and McDunnough, 1917: 190 [checklist].— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist].

Gelechia monstratella Walker, 1864: 594. **Synonymy unconfirmed.**

Butalis monstratella ; Walsingham, 1888: 113 [as a synonym of *B. impositella*].— Smith, 1891: 107 [checklist, as a synonym of *B. impositella*].

Scythris monstratella ; Dyar, 1902: 538 [catalogue].— Barnes and McDunnough, 1917: 190 [checklist].— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist] [in all citations, as a synonym of *S. impositella*].

Notes about identity. — From Zeller's description, which covers only external features, it is impossible to decide with certainty whether *S. impositella* is conspecific with *S. matutella* (Clemens), or represents the species here described whose adults are externally very similar to *S. matutella* . Both species have varied forewing pattern and can only be separated with certainty by characters of the genitalia. Zeller described in some detail the proximal fascia of the forewing, mentioning the curved portion below the fold and the more straight portion over the fold: this suggests that *S. impositella* is not the same as *S. matutella* because in the latter, very few specimens have such a portion of the proximal fascia curved below the fold, and in those specimens with one, it is barely distinct. Zeller also mentioned in his description of *S. impositella* that the visible parts of the male valvae ("Zangen") are shiny black and this agrees with what is visible in dry specimens of the species described below rather than in *S. matutella* . In dry specimens of the latter, some testaceous is clearly visible along with dark brown parts. On that basis I have decided to tentatively recognize the species described below as *S. impositella* and as specifically distinct from its former synonym *S. matutella* . Examination of the genitalia of the type of *S. impositella* will be necessary to confirm its identity.

Notes about synonymy. — *Gelechia monstratella* : this name has been synonymized with *S. impositella* (Zeller) by Walsingham (1888: 113) but the synonymy must remain doubtful until genitalia of the type of *G. monstratella* have been examined. Walker's original description states: "with two pale yellowish cinereous spots on the disk". Because *S. impositella* (as tentatively interpreted here— see "Notes about identity") is the only Nearctic scythridid that I have seen with such color pattern and ranging as far north as the type locality of *G. monstratella,* I provisionally maintain the synonymic status of *G. monstratella* Walker.

Four other species, namely *S. brevistrigella* (Chambers), *S. dorsipallidella* (Chambers), *S. immaculatella* (Chambers) and *S. matutella* (Clemens), have been indicated as conspecific with *S. impositella* in the past (see references under those respective names). Reasons for removing the first three names from synonymy are explained under each respective species, those for removing *S. matutella* are given above under "Notes about identity".

Type material. — ***Butalis impositella*** : Type material in BMNH and not examined.

Gelechia monstratella : Type material in BMNH, and not examined.

Type localities. — ***Butalis impositella*** : New York, as given by Zeller. *Gelechia monstratella* : "St. Martin's Falls, Albany River, Hudson's Bay", as given by Walker (*loc. cit.*); this is undoubtedly the same as Marten Falls, Cochrane District, Ontario.

Recognition. — Adults of *S. impositella* are very similar to those of *S. matutella* in size, color and fasciate pattern of forewings. In many fasciate specimens of *S. impositella* however, the pale fasciae are more distinct and more sharply defined than in corresponding specimens of *S. matutella* , but this feature is not reliable for separation of the two species. Specimens of *S. impositella* are readily distinguished from those of *S. matutella* by characters of male and female genitalia, and diagnostic differences are given under the latter species . Specimens of *S. impositella* are also extremely similar in external aspect to those of another closely related but undescribed species from Arizona and New Mexico. The former are characterized by the simple, wedge-like basal lobe of the gnathos, the thick distal arm of the gnathos with the apex scoop-like, and the coiled bulbus ejaculatorius (Figs. 240, 243-244); in the undescribed species, the basal lobe of the gnathos is distally divided into two sublobes, the distal arm of the gnathos is thin with the apex mushroom-like and the bulbus ejaculatorius is uncoiled, subcrescentic.

Description. — Size. Forewing length 4.9-6.3 mm (mean = 5.5); hindwing length 4.2-5.5 mm (mean = 4.8); wing expanse 10.4-14.0 mm (mean = 12.1) (20 specimens).

Head. Face and neck tufts olive-brown or dark brown, with moderate or marked golden, brassy, cupreous or purplish metallic lustre, in some specimens lateral portions of face and neck tufts with some pale drab. Eye elongate-oval, markedly narrower than frons. Haustellum base covered with olive-brown scales, or with mixture of drab and whitish scales. Maxillary palpi inconspicuous, not extended over base of haustellum. Labial palpi porrect, or slightly or distinctly upcurved with last article vertical and extended to scape or to level of vertex; article 1 white, ochreous or pale drab; basal half and inner side of article 2 and, in most specimens, inner side of article 3 colored as article 1, rest olive-brown or dark brown. Antenna extended to slightly beyond middle of forewing, filiform, colored as face, in some specimens proximal third antero-ventrally with white or whitish; scape without pecten; flagellum ventrally densely ciliate in males, moderately so in females.

Thorax. Dorsal surface with same color and metallic lustre as face, in several specimens more pronouncedly purplish; in most specimens distal half or two-thirds of tegulae and, in several specimens, latero-posterior portion of mesoscutum ochreous, whitish or white; in few specimens surface unicolorously colored as face. Ventral surface laterally drab or grey-drab, with moderate brassy or golden lustre, medially white, whitish or ochreous. Legs drab, pale olive-brown or olive-brown, scatteringly suffused with some whitish or ochreous; in several specimens trochanters and femora white or whitish, in some specimens inner side of legs predominantly white or whitish with scattered drab scales.

Wings. Frenum present. Forewing shape as in *S. matutella* ; upper surface with ground color brown, olive-brown or dark brown, blackish brown, with moderate or marked brassy, cupreous or purplish metallic lustre, in most specimens with two white, whitish or pale ochreous fasciae, one in basal half and one pre-apical at end of cell; proximal fascia extended from base below fold, curved posteriorly along hind margin and extended obliquely and transversely over fold and toward costal margin (Figs. 45-46), in most specimens portion over fold broadened, in several specimens curved portion below fold ± indistinct (Fig. 45); pre-apical fascia extended transversely from about middle of disc to termen, in most specimens fascia somewhat broadened, in few specimens rounded and spot-like, in some specimens ± indistinct; in some specimens both fasciae very indistinct or surface immaculate (Fig. 48); ventral surface grey, drab, grey-drab or pale olive-brown, with moderate golden metallic lustre, in females disc dark brown; cilia drab, olive-brown or dark brown, with moderate brassy and purplish lustre. Hindwing shape as in *S. matutella* ; upper surface uniformly drab, olive-brown or dark brown, with moderate pale golden or brassy metallic lustre and light iridescent hue; ventral surface colored as that of forewing; cilia colored as those of forewing. Venation as in *S. matutella* ; female frenulum with two bristles.

Abdomen. In males, dorsal surface grey-drab, olive-brown, rufous brown or dark smokey grey, with moderate cupreous or pale golden metallic lustre and reddish-greenish hue; ventral surface in basal third or half and laterally drab, grey or olive-brown with same lustre as dorsal surface, medially and distally white, whitish or ochreous, in several specimens pale portion mixed with scattered drab or olive-brown scales, in some specimens pale portion restricted to terminal two sterna and to scattered suffusion medially on other sterna; terga darkly sclerotized, anteriorly margined; T8 unmodified, subquadrate, elongate-trapezoid or conical; sterna lightly or darkly sclerotized, unmargined; S8 unmodified, transverse. In females, dorsal surface in most specimens with T1-T5 medially olive-brown or dark smokey grey and laterally drab, T6-T7 drab, in some specimens entire surface ± uniformly olive-brown or dark grey, with moderate or marked golden or brassy metallic lustre and light iridescence; ventral surface in most specimens with S1-S6 predominantly white, whitish or ochreous, with lateral portions olive-brown or grey-drab, in some specimens basal third or half variously dark as laterally, S7 mostly or entirely olive-brown or brown, in some specimens surface mostly drak grey, S6 whitish; terga and sterna 1-6 lightly sclerotized, T3-T6 with fine or indistinct anterior margin, sterna unmargined; segment 7 moderately sclerotized; T7 elongate-rectangular; S7 (Fig. 338) elongate-trapezoid, caudal margin medially with shallow, rounded emargination, sides of emargination with pincer-like projections projected ± ventrally at an angle with plane of sternum and bracing base of sterigma.

Male genitalia (Figs. 86-88, 240-244). Strikingly asymmetrical and darkly sclerotized. Tegumen transversely markedly arched, in dorsal aspect (Fig. 242) asymmetrically subconical, in lateral aspect (Figs. 240, 243) more regularly conical; anterior margin broadly reflexed inwardly; left side extended farther ventrally than right side; caudal margin medially with one or two long, fine setae. Uncus fused to tegumen and base of gnathos, somewhat indistinct, reduced to small, darkly sclerotized, subconical process partly recessed under protruded caudal margin of tegumen (Fig. 243). Gnathos (Figs. 240-243) large, markedly asymmetrical, skewed to left of genitalia; base of left proximal arm caudally protruded into large, thickly sclerotized and darkly melanized, wedge-like process; inner side of wedge-like lobe with fish-scale-like microsculpture (Fig. 88); left proximal arm curved leftward, fused to posterior margin of tegumen; right proximal arm narrow, medial, basally with very small lobe; distal arm (Figs. 240-241, 243) projected caudally, very thick, apical portion darkly melanized, upcurved, dilated, scoop-like or subclavate, with margins serrate or spinose. Vinculum (Fig. 244) extended caudally beneath genitalia, as medially concave, ± mushroom-like plate. Valvae (Fig. 244) basally fused to vinculum, markedly asymmetrical; right valva about twice larger than, and situated in plane above, left valva, heavily sclerotized, costa in basal third deeply emarginate, distal portion of valva dilated, wedge-like with inner side concave, and with patch of fine setae; left valva simple, ± rod-like, slightly incurved, costa with row of fine, short setae. Juxta small, narrow band attached ventro-basally to aedeagus, extended ventrally and articulated to anterior margin of vinculum. Aedeagus tubular, distally attenuate, situated on right side of genitalia with apical third abutting costal emargination of right valva, ankylozed dorsally by stiffened diaphragma and ventrally by juxta; bulbus ejaculatorius (Fig. 244) relatively large, coiled one or two times, in few specimens straight and with lateral digitiform lobe.

Female genitalia. T8 slightly sclerotized anteriorly and laterally, medially membranous, posterior margin with few fine setae. S8 membranous. Sterigma (Fig. 339) developed, situated on intersegmental membrane between S7 and S8, elongate-conical, with apex markedly tapered to very fine tube. Ostium at apex of sterigma, very small. Ductus bursae and corpus bursae (Fig. 389) as in *S. matutella* . (Spermatheca not studied). Anterior apophyses straight, parallel, slightly shorter than T7. Posterior apophyses of about same thickness as, and about 2x length of, anterior ones. Ovipositor about 0.3x length of T1-T7, papillae anales membranous, elongate, as long as preceding portion of ovipositor.

Variation. — Adults of *S. impositella* are varied mostly in the shape, extent and distinctiveness of the pale fasciae of forewings. In most specimens, both fasciae are distinct (Figs. 46-47). In several specimens however, the basalmost and the curved portion of the proximal fascia are indistinct and reduced to a few scattered pale scales (Fig. 45); in such specimens the transverse portion of the proximal fascia, which is extended obliquely over the fold near the middle, is broad and, in some specimens, spot-like. The distal fascia is, in most specimens, somewhat elongate, transverse and extended from the termen to the middle of disc or almost to costa, but in several specimens is small and spot-like near the termen. Several specimens from the Ottawa area of Ontario are with very indistinct or without forewing fasciae (Fig. 48).

In male genitalia, the tegumen varies from more or less regularly conical or asymmetrically so in most specimens, to rounded, subhemispherical in few specimens. The basal process of the left proximal arm of the gnathos varies from narrow, laterally compressed, wedge-shaped and elongate with the apex extended beyond that of the distal arm (Fig. 243), to laterally broadened, tooth-like and short with the apex anterior to that of the distal arm (Fig. 240). The right valva has the distal portion dilated and more or less wedge-shaped in most specimens, but in few specimens it is somewhat tapered, sinuate and barely wider than that of the left valva. The bulbus ejaculatorius has two coils in most specimens, but in some specimens has only half a coil or is straight. Variation in female genitalia was not examined.

Phylogenetic relationships. — See under *S. scintillifera* .

Geographical distribution and period of flight. — Transamerican, ranging at somewhat median latitude, north to central Alberta, south to Georgia (Fig. 405). This is probably a temperate to sub-boreal species occurring in mesic areas. Adults occur from mid- or late May to early September. Moths reared from larvae emerged in June and August. The very long seasonal occurrence and emergence of adults both early and late in the summer suggests that the species may be bivoltine at least in parts of its range. Adults are diurnal and can be collected by sweeping herbaceous vegetation. They have also been collected in Malaise traps.

Hostplants. — Larvae have been reared from various species of *Aster* (Compositae) on which they make a blotch mine on leaves; recorded host species are *A. cordifolius* , *A. laevis* , and *A. novae-angliae* .

3.3.23 *Scythris scintillifera* Braun

(Figs. 38, 160, 248, 407)

Scythris scintillifera Braun, 1927: 59.— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist].

Type material examined. — HOLOTYPE male in ANSP, labelled: "Sparrow Lake/ Ont. vii.13.26/ A.F. Braun" [white, printed]; "TYPE/ Collection of/ Annette F. Braun." [red, printed]; "Scythris/ scintillifera/ Type Braun" [white, with black-lined top and bottom borders, handwritten]; "[male symbol] genitalia on/ slide no./ JFL-85-0274/ by J.F. Landry/ ANSP coll." [green, partly printed, partly handwritten, added by me]; "ANSP" [pale yellow, printed, two back to back]. Abdomen and genitalia dissected and mounted on slide no. JFL-85-0274.

Type locality. — Sparrow Lake (near Severn Bridge), Muskoka District, Ontario.

Recognition. — Adult males are medium-small scythridids with the head, upper surface of thorax and forewings markedly metallic golden brown (Fig. 38). They are somewhat similar in ground color of forewings to specimens of *S. graminivorella* and some specimens of *S. impositella* . Specimens of *S. graminivorella* are of a lighter, duller metallic hue and have distinct fasciae (Fig. 39). Uniformly colored specimens of *S. impositella* (Fig. 48) have duller and more bronzy forewing color with marked, reddish hue. Specimens of *S. scintillifera* are best distinguished by features of male genitalia (Fig. 248) in having a suborbicular, dome-shaped tegumen, dorsally protruded, sinuate basal lobe of gnathos, mushroom-like distal lobe of gnathos, a dilated, incurved, outwardly concave right valva larger than the left one, and a large, coiled bulbus ejaculatorius. Males of *S. impositella* also have a coiled bulbus but are easily distinguished by other features of genitalia (see under that species)

Description. — This species is known only from males.

Size. Forewing length 5.1-5.9 mm (mean = 5.5); hindwing length 4.0-5.1 mm (mean = 4.8); wing expanse 11.2-12.9 mm (mean = 12.2) (8 specimens).

Head. Face and neck tufts markedly metallic golden brown or, in some specimens almost dull olive-brown, in some specimens with purplish hue. Eyes relatively small, markedly narrower than frons. Haustellum with olive-brown scales suffused with whitish. Maxillary palpi small, inconspicuous. Labial palpi extended to slightly below vertex, whitish, distal half of article 2 and article 3 olive-brown, in some specimens slightly suffused with whitish. Antenna extended to two-thirds length of forewing, olive-brown with metallic purplish hue.

Thorax. Dorsal surface colored as face. Ventral surface shiny whitish or drab. Legs shiny greyish, drab or light olive-brown with purplish or golden hue.

Wings (Fig. 160). Forewings elongate-lanceolate, apex subacute, termen sinuate; upper surface metallic dark golden-brown, in some specimens with indistinct short, dark-brown streak medially in fold and similarly colored spot in apical third near termen; ventral surface grey-brown with marked reddish, purplish or bluish hue; cilia brown with reddish or purplish hue. Hindwings narrowly elongate-lanceolate; upper surface light metallic golden-brown, sparsely scaled; ventral surface greyish-brown; cilia colored as in forewings. Venation (Fig. 160) as in *S. limbella* except as follow: forewing with Sc extended to costa before middle, M2 and M3+CuA1 short-stalked, CuP very short and obsolete at margin; hindwing with Sc+R1 extended to costa at about middle, M2 and M3 separate, CuP absent.

Abdomen. Dorsal surface olive-brown or grey-brown with reddish, golden or purplish metallic hue. Ventral surface latero-basally dirty white, otherwise olive-brown suffused with buff or clay-color. Terga and sterna (as seen in potash-cleared specimens) distinctly sclerotized. Terga 2-8 anteriorly margined; sterna unmargined except S8 anteriorly margined. T8 unmodified, anterior margin medially sinuate. S2 and S3 latero-posteriorly with small fenestra. S8 unmodified, transverse, almost as large as S7.

Male genitalia (Fig. 248). Strikingly asymmetrical. Tegumen very convex, hemispherical, dome-like; anterior margin fused to sclerotized, tongue-shaped intersegmental membrane extended above tegumen. Uncus very small, inconspicuous, vertical plate fused to base of right arm of gnathos, with 3-4 setae. Gnathos strikingly developed, asymmetrical, shifted to left side of genitalia, fused to dorso-caudal margin of tegumen; left basal arm baso-dorsally expanded into sinuate, laterally compressed, darkly sclerotized lobe with very fine fish-scale-like microsculpture; distal portion of left arm curved along left portion of caudal margin of tegumen, extended medio-ventrad and joined to right arm at level of valvae; right arm broad and flat, expanded under tegumen; distal arm oriented caudad, medially dilated, apex recurved, toothed, heavily sclerotized, more or less mushroom-like, extended ventrad of valvae. Vinculum asymmetrical, tongue-shaped flap protruded ventro-caudally, articulation with tegumen nearly ankylosed. Valvae strikingly asymmetrical; right valva markedly dilated, about twice larger than left one, markedly incurved, outer side concave, base constricted, inner side basally with blunt process; left valva slightly incurved, apex moderately dilated and rounded, costa with some scattered setae. Aedeagus short, stout, caudally attenuate, ankylosed to vinculum by small projection (? juxta) attached to left side of base; shaft obliquely oriented to right, apex proximate to inner basal process of right valva. Bulbus ejaculatorius larger than genitalia, coiled one or two times.

Variation. — Color of face, upper surface of thorax and forewings varies slightly from markedly metallic golden brown in most specimens to almost dull olive-brown with light purplish hue in some specimens. The dark brown spots of forewings, when present in some lightly colored specimens are very indistinct. In male genitalia, the bulbus ejaculatorius is coiled one or two times; in one specimen examined, the coils were somewhat irregular.

Phylogenetic relationships. — Closely related to *S. impositella* on the basis of apomorphic features of male genitalia: both species possess a darkly sclerotized (black in color), protruded lobe with fish-scale-like microsculpture at the base of gnathos, a recurved, scoop-like and serrate or spinose apex of gnathos, a right valva larger than the left one and a coiled bulbus ejaculatorius.

Geographical distribution and period of flight. — Known from widely scattered records in Nova Scotia, southern Ontario, Michigan, southernmost Alberta, and in mountainous parts of north-central Colorado and northern New Mexico407). Adults occur from mid-July to mid-August and are probably diurnal. In southern Alberta, one specimen was collected during day time by sweeping sagebrush (pers. obs.).

Hostplant. — Unknown.

3.3.24 ***Scythris reducta*** **Braun**

(Figs. 37, 161, 245-247, 334-335, 390, 415)

Scythris reducta Braun, 1923a: 122.— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist].

Type material examined. — HOLOTYPE female in ANSP, labelled: "Olancha/ Inyo Co. Cal./ v.26.17" [white, printed]; "TYPE/ Collection of/ Annette F. Braun." [red, printed]; "Scythris/ reducta/ Type Braun" [white, with black-lined top and bottom borders, handwritten]; "ANSP" [pale yellow, printed, two back to back]. The specimen is not dissected.

PARATYPES, five males and five females (ANSP), with collection labels as that of holotype except for date: one female, v.9.17; one female, v.12.17; four males, one female, v.17.17 (three males double-mounted on the same cork black); one male, two females, v.19.17. All specimens also have a red label in Braun's handwriting marked "Paratype". One male has two additional labels as follow: "Scythris/ reducta/ Paratype Braun" [white with black-lined upper and lower borders, in Braun's handwriting]; "PARATYPE/ Scythris/ reducta/ Braun" [blue, partly printed, partly handwritten, not Braun's original]. Abdomen and genitalia of a male paratype dissected and mounted on slide no. JFL-85-0273.

Type locality. — Olancha, Inyo Co., California.

Recognition. — Adults are small olive-brown scythridids distinguished by their striking pattern of white streaks in forewings (Fig. 37): a costal streak from base to middle, in some specimens extended to apex, and a broad discal streak in fold from base to apex, shortly forked at two-thirds of wing with one branch ± to apex, the other to termen; the distal third is densely suffused with white. Males are also distinguished from all other Nearctic scythridids by their very small, compact male genitalia (Figs. 245-247) with subhemispheric tegumen, curved, spine-like gnathos projected caudad or dorso-caudad, and very short, heavily sclerotized, asymmetrical valvae. In females, color pattern of upper surface of abdomen, olive-brown with lateral margins white, is also characteristic in combination with the forewing pattern. In features of genitalia, they are characterized by their asymmetrically conical sterigma (Fig. 335) and large ductus seminalis with a broad loop (Fig. 390).

Description. — Size. Forewing length 3.7-4.7 mm (mean = 4.4); hindwing length 3.5-4.3 mm (mean = 4.0); wing expanse 8.4-10.6 mm (mean = 10.0) (5 specimens).

Head. Face pale olive-brown with whitish suffusion and light metallic lustre; in many specimens clypeal area mostly whitish; neck tufts white. Eye small, less than half width of frons. Haustellum base with mostly whitish scales suffused with some olive-brown. Maxillary palpi extremely small, inconspicuous, one article only. Labial palpi upcurved, extended to level of vertex, white, article 3 and, in some specimens, article 2, variously suffused with olive-brown. Antenna short, extended to slightly less than half of forewing length, drab or olive-brown with metallic lustre, scape and pedicel ventrally whitish; cilia distinct; scape basally with small, tufted pecten of 3-4 scales.

Thorax. Dorsal surface with metallic lustre, pale drab, drab or olive-brown, with collar and posterior angles of mesoscutum whitish. Ventral surface white with light metallic lustre. Legs: proximal portion white; in most specimens tibiae white suffused with olive-brown, tarsi mostly olive-brown; in some pale specimens tibiae white, tarsi white with some drab suffusion.

Wings (Fig. 161). Frenum present. Forewing elongate-lanceolate, apex pointed, termen indistinctly sinuate; upper surface, in most specimens, with ground color olive-brown with faint purple hue, fold with broad, white streak from base to two-thirds and distally ± distinctly forked with anterior branch extended diffusely to apex and posterior branch to termen (Fig. 37); costa with white streak from base to about middle, in some specimens to apex where broadened into suffusion; apical quarter densely suffused with white; in some specimens, disc area behind streak with very scattered white suffusion; in few specimens, upper surface pale whitish drab, white streaks very broad, extended over most of wing; ventral surface drab or whitish-drab with light metallic lustre, distally drab-ochreous, fold with distally broadened ochreous streak, distal portion suffused with white; cilia yellowish-brown or pale olive-brown. Hindwing narrowly elongate-lanceolate, apex acute, hind margin nearly straight; upper surface pale drab with light metallic lustre, basally scatteringly scaled; ventral surface, in males white, in females white with pale drab streak along Rs and in posterior area; cilia colored as in forewing; female frenulum with two bristles. Venation (Fig. 161) as in *S. limbella* except as follow: forewing with Sc to costa before middle, R5 in some specimens very short at termen, M branches and CuA1 reduced or anastomosed, in some specimens M1+M2 and M3+CuA1 as separate veins, the latter obsolete, in other specimens single short-stalked vein present (probably M3+CuA1); hindwing with Sc+R1 obsolete beyond middle, Rs and M1 stalked, Rs to costa, M1 to hind margin, M2 and M3 anastomosed, obsolete, CuA1 and CuA2 very short at hind margin.

Abdomen. In males, dorsal surface drab, grey or olive-brown with slight iridescent hue, in some specimens variously suffused with white; ventral surface white with faint metallic lustre. In females, dorsal surface drab or pale olive-brown with moderate iridescent hue, laterally anterior half of segment white; in some specimens, white area expanded toward middle, most of tergum 7 white; ventral surface white.Terga and sterna (as seen in potash-cleared specimens) in males, markedly sclerotized, terga anteriorly margined, S2-S3 with small fenestra at postero-lateral angle; segment 8 unmodified. In females terga and sterna 1-6 as in males, T7 elongate-rectangular; S7 (Fig. 334) trapezoid, caudal margin medially with shallow U-emargination with very small (indistinct in some specimens) lateral teeth.

Male genitalia (Figs. 245-247). Very small and compact, asymmetrical. Tegumen short, strikingly convex, subhemispherical, slightly asymmetrical in caudal aspect (Fig. 246), anterior margin bent ventrad and inward. Uncus (best seen in ventral aspect; Fig. 247)) as small, darkly sclerotized, irregularly subquadrate or subconical plate, dorsally with patch of short, fine setae. Gnathos reduced, displaced to left side on dorso-lateral margin of tegumen, as curved, thorn-like or spine-like process projected dorso-caudad or caudad; distal arm absent. Vinculum (Fig. 247) reduced, as transverse narrow plate fused to base of valvae. Valvae (Fig. 247) basally fused to vinculum, darkly sclerotized, asymmetrical, very short, stubby; left valva incurved, distally setose, apex tapered and truncate; right valva shorter and broader, subglobulose in caudal aspect, distally setose, apex with two inwardly directed blunt teeth. Juxta as narrow band attached ventromedially to aedeagus and joined obliquely to inner base of left valva. Aedeagus ankylozed, small short, tubular, slightly bent rightward, apical portion tapered, wedged between uncus and apical tooth of right valva; bulbus ejaculatorius smaller than genitalia, subovoid, right side sinuate, broadly open.

Female genitalia. T8 narrowly elongate-rectangular, anteriorly and laterally narrowly and indistinctly sclerotized, otherwise membranous with fine longitudinal striulae, caudal margin with few fine setae. S8 membranous. Sterigma (Fig. 335) on membrane between S7 and S8, as markedly sclerotized, asymmetrical, short cone oriented obliquely, apex directed leftward, base explanate, ventral surface compressed, subconcave. Ostium very small, at apex of sterigma. Ductus bursae fine, membranous, inception laterally in constriction of caudal third of bursa. Corpus bursae (Fig. 390) elongate-ovoid, medially markedly constricted, caudal portion about half size of anterior one; caudally abruptly narrowed into broad ductus seminalis, ductus braodly looped, loop extended cephalad to almost anterior end of bursa. (Spermatheca not examined). Anterior apophyses relatively long, about 1.5x length of T8, slightly divergent, in some specimens anterior apical portion abruptly sinuate. Posterior apophyses very thin, about 1.25x length of anterior ones. Ovipositor moderately long, about 0.30 length of T1-T7; papillae anales membranous.

Variation. — Ground color, in most specimens examined, is olive-brown or pale olive-brown. Some specimens have very pale drab ground color and broader white markings on forewings but have the same pattern as darker specimens. In venation of forewing, some specimens have M1+M2 and M3+CuA1 present, the latter being obsolete; in other specimens, the

M branches are reduced to a single, forked vein (probably M3+CuA1). Variation in genitalia was not examined.

Phylogenetic relationships. — The marked asymmetry in male genitalia, conical sterigma and small, toothed emargination of S7 on female abdomen suggest relationship to the *S. impositella* complex, hence its tentative placement after this group.

Geographical distribution and period of flight. — Known only from three localities in the Mojave desert of southern California: Olancha, Inyo Co., Helendale, San Bernardino Co., and Shadow Mtn., San Bernardino Co (Fig. 415). Adults were collected from mid-May to late June; they are diurnal and go to flowers.

Hostplant. — Unknown.

3.3.25 *Scythris fissirostris* Meyrick

(Figs. 33-34, 159, 249-254, 340-341, 391, 414)

Scythris fissirostris Meyrick, 1928: 413.— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist].

Type material examined. — Type material mostly in BMNH and not examined. LECTOTYPE designated by Clarke, 1965: 574 . For notes about type material, see Clarke (*loc. cit.*).

PARALECTOTYPES examined, two males and one female (USNM), labelled as follow:

Male: "Brenster [sic] Co./ Texas/ 5000 ft. .4-26" [printed]; "Comp. with type./ Scythris/ fissirostris/ Meyrick/ Det. J.F.G.C. 1948"; "Scythris/ fissirostris/ 35/33/ Meyr./ E. Meyrick det./ in Meyrick Coll." [Meyrick label]; "Meyrick Coll./ B.M. 1938-290" [printed]; "[male symbol] genitalia on/ slide no./ JFL-83-1040/ by J.F. Landry/ in USNM coll." [green, partly printed, partly handwritten, added by me].

Female: "Brenster [sic] Co./ Texas/ 5000 ft. .4-26" [printed]; "Scythris/ fissirostris/ Paratype Meyr/ AB Jun 1932" [written in blue by Busck]; "Scythris/ fissirostris/ Paratype Meyr/ [female symbol] genitalia/ on slide/ AB Dec 14 1933" [handwritten].

Male: "Forestburg/ Texas/ .7.27" [handwritten by Meyrick]; "Scythris/ fissirostris/ Paratype Meyr/ AB Jun 1932" [written in blue by Busck]; "Scythris/ fissirostris/ Paratype Meyr/ [male symbol] genitalia/ on slide/ AB Dec 14 1933" [handwritten].

Even though none of the above paralectotypes is so labelled, agreement of the label data with those given by Meyrick with the original description, Clarke's comparison label attached to the first male, and Busck's paratype indication on labels of the second and third specimens provide evidence of their paralectotype status.

Type locality. — Brewster Co., Texas (5000-7000 feet) (elevation given by Meyrick).

Recognition. — Adults are medium-sized, slender-winged scythridids with ground color of upper surface of forewings grey with a broad white streak in fold and suffusedly streaked with white and brown, or predominantly whitish with fine, indistinct brownish streaks (Figs. 33-34). A few undescribed species have a somewhat similar color and color pattern; specimens of *S. fissirostris* are best distinguished from them by features of male and female genitalia. In males, T8 (Fig. 253) and S8 (Fig. 254) have apodemes at the anterior angles, the tergal apodemes with the apex markedly incurved, the tegumen (Fig. 251) is elongate with the anterior margin dorsally very deeply U-emarginate, the uncus (Fig. 249, 251) is a large, prominent, sinuose process with a medio-ventral blunt tooth, the base of gnathos (Fig. 249) has a ledge-like process, the distal arm of gnathos is medially bent caudad at an almost right angle, and the valvae are short, parallel, flat rods. In females, S7 (Fig. 340) has a shallow medial groove and the sterigma (Fig. 341) is a short, blunt cone braced by the protruded latero-posterior angles of S8.

Description. — Size. Forewing length 5.2-7.8 mm (mean = 5.9); hindwing length 4.2-6.6 mm (mean = 5.2); wing expanse 10.6-16.9 mm (mean = 13.0) (12 specimens).

Head. Face whitish suffused with light brown; in dark specimens, vertex and occiput mostly brown; in light specimens, face mostly white; neck tufts white. Eyes moderately large, very convex, almost as wide as frons. Haustellum base with white scales. Maxillary palpi conspicuous, folded over base of haustellum, white. Labial palpi extended to level of vertex; article 1, basal half of 2 and distal third of 3 white, distal half of 2 and proximal two-thirds of 3 ventrally olive-brown. Antenna filiform, long, extended to two-thirds of forewing; scape, peidcel and a few proximal articles of flagellum white, drab or white suffused with olive-brown, rest of flagellum olive-brown or drab; scape ventrally with fairly dense pecten of long, drab scales.

Thorax. Dorsal surface of mesothorax medially brownish grey, drab or light grey, laterally white. Tegulae and collar whitish suffused with some light drab or brown. Ventral surface white. Legs, in light specimens, white lightly suffused with light drab or ochreous; in dark specimens, white heavily suffused with olive-brown; hind tibia mostly white, brush yellowish, apex of spurs olive-brown in most specimens; tarsi darker than rest of legs, densely suffused with olive-brown.

Wings (Fig. 159). Forewing narrowly elongate-lanceolate. In dark specimens (Fig. 33), upper surface with ground color dark grey or grey, with irregular white streak in fold extended from base to two-third or to termen, streak baso-posteriorly edged with short, dark brown streak; in some specimens, white streak longitudinally divided by grey streak; rest of upper surface strewn or suffusedly streaked with white; distal two-thirds of costa white; ventral surface grey. In pale specimens (Fig. 34), upper surface of forewing with ground color white strewn or suffusedly streaked with drab, brown or dark brown, in most specimens with small spot at two-third of wing near termen; ventral surface yellowish-grey. Hindwing narrowly elongate-lanceolate, in light and dark specimens with both surfaces grey. Venation (Fig. 159) as in *S. confinis* except as follow: forewing with somewhat indistinct pterostigma extended along costa from point proximal to R1 to R2; Sc extended to costa before middle; R4+5, M1, M2 and M3+CuA1 parallel, very proximate; M3+CuA1 distinct near margin; hindwing with Sc+R1 distally confluent with Rs over short distance; M1 medially confluent with, and distally divergent from, Rs; M2 and M3 forked.

Abdomen. Upper surface yellowish-white or greyish-white with light or moderate iridescent hue. Ventral surface dull white, in some specimens with scattered buff or yellowish scales. In males, terga and sterna (as seen in potash-cleared specimens) distinctly sclerotized, terga finely margines, sterna unmargined; T8 (Fig. 253) elongate-rectangular, antero-lateral angles prolonged into distally incurved apodemes, postero-lateral angles prolonged into short, curved rods; S8 (Fig. 254) transversely subquadrate, antero-lateral angles prolonged into straight, parallel apodemes, caudal margin rounded. In females, terga and sterna very lightly sclerotized, unmargined; T7 elongate-rectangular; S7 (Fig. 340) trapezoid, caudal margin slightly emarginate, distal half medially with shallow, smooth, lanceolate groove.

Male genitalia (Figs. 249-252). Tegumen elongate, anteriorly very deeply and narrowly U-emarginate, cleft extended to three-quarter length of tegumen (Fig. 251); sides suborbicular in lateral aspect (Fig. 249), with inflexed margins; pedunculi undeveloped. Uncus (Figs. 249, 251) fairly large, thick, asymmetrical, more or less digitiform, sinuose and downcurved process, ventro-medially with smaller blunt process. Gnathos slightly asymmetrical, with base fused to caudal margin of tegumen (Fig. 252); left basal arm slightly longer than right one; medially produced into heavily sclerotized, asymmetrical, ledge-like, dorsally concave process (Figs. 249, 252); distal arm very long, pointed obliquely cephalad, distal portion bent caudad at almost right angle, apex hooked (Fig. 249). Vinculum (Fig. 250) asymmetrical, transverse, bilobate, left lobe about twice larger than right one. Valvae (Fig. 250) fused to vinculum, parallel, flat, blade-like, apically setose, extended to apex of medial process of gnathos. Juxta a small, inconspicuous flap ventrad of aedeagus, fused medially on vinculum. Aedeagus ankylosed to juxta, distal half bent dorsad, skewed to right side, apex attenuate and directed to right side of gnathos (Fig. 249). Bulbus ejaculatorius subcrescentic, about half size of genitalia, with antero-lateral protrusion.

Female genitalia (Figs. 340-341). T8 slightly sclerotized, longitudinally divided by membranous, wrinkled area; anteriorly indistinctly margined; lateral portions extended ventrad on pleural area; caudal margin with a few fine setae. S8 (Fig. 340)elongate-rectangular, slightly sclerotized, latero-caudal angles protruded around sterigma, setose; anterior margin straight or rounded. Sterigma (Fig. 341) conical, apically truncate projection about length of S8, base inserted medio-posteriorly on S8. Ostium small, apical on sterigma, pointed caudad. Ductus bursae fine, membranous, inserted latero-medially on bursa. Corpus bursae (Fig. 391) thin, delicate, somewhat pear-shaped, caudal portion abruptly narrowed into ductus seminalis. Spermatheca somewhat fusiform, folded on itself, distal half of spermathecal duct with many coils, coils gradually widened toward spermatheca. Anterior apophyses thin, parallel, slightly onger than T8. Posterior apophyses very thin, about twice length of anterior ones. Ovipositor about twice length of T8; papillae anales membranous.

Variation. — Adults are varied mostly in color of the dorsal surface of forewings, from dark grey with suffused white and brown streaks (Fig. 33) to whitish with indistinct grey or brownish streaks or light suffusion (Fig. 34). Most pale specimens examined are from the Chisos Mts., Brewster Co., Texas. Variation in genitalia was not examined.

Phylogenetic relationships. — Related to *S. confinis* and to *S. planipenella*. These and several other undescribed species belong to a group generically distinct from, an unrelated to, *Scythris* in a strict sense, based on apomorphic features of the gnathos. Meyrick (1928: 413) stated that *S. fissirostris* is closely related to *S. dividua* Meyrick from Peru on the basis of similar color pattern, but examination of the male genitalia of the latter species (Clarke 1965: 574) shows that this is not so and that *S. dividua* belongs to a different, undescribed and unrelated genus.

Geographical distribution and period of flight. — Known to range in the Southwest, from Texas to southeastern California (Fig. 414). Adults have been collected from April to late June in Texas, in early August and mid-October in Arizona, and in late April in California. They are nocturnal and are attracted to light.

Hostplant. — Unknown.

3.3.26 *Scythris confinis* Braun

(Figs. 35, 255-258, 342-343, 392, 414)

Scythris confinis Braun, 1920: 40.— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist].

Type material examined. — HOLOTYPE male in ANSP, labelled: "Alameda Co./ Cal. v.22.08/ G.R. Pilate." [white, printed]; "TYPE/ Collection of/ Annette F. Braun." [red, printed]; "Scythris/ confinis/ Type Braun" [white with black-lined top and bottom borders, handwritten]; "[male symbol] genitalia on/ slide no./ JFL-85-0270/ by J.F. Landry/ ANSP coll." [green, printed except male symbol and number handwritten; this label was added by me]; "ANSP" [pale yellow, printed; there are two of them back to back]. Abdomen and genitalia dissected and mounted on slide no. JFL-85-0270.

PARATYPES examined, 10 females (ANSP), labelled same as holotype except two females with dates "v.28.08"; all with a red handwritten label marked "Paratype" in Braun's handwriting. Two females with an additional blue label marked "PARATYPE/ Scythris/ confinis/ Braun" and not in Braun's handwriting; one of the latter females with one additional label:

"Scythris/ confinis/ Paratype Braun" [white with black-lined top and bottom margins, in Braun's handwriting].

The paratype series examined is composite. One female with date "v.22.08" is smaller, has uniformly dark metallic bronze forewings, a deeply and broadly indented apical margin of S7 with protruded sides and the exposed portion of the sterigma shaped as a short, subtruncate cone. This female specimen probably belongs to an undescribed species related to *S. matutella* (Clemens).

Braun (*loc. cit.*) indicated that there were 35 paratypes when she described the species. Location of the rest of these other than those mentioned above is unknown.

Type locality. — Alameda Co., California.

Recognition. — Adults are medium-small scythridids with mostly dark brown upper surface. Most specimens have the upper surface of forewings with an ochreous streak in fold extended from base to about middle of wing (Fig. 35). In some specimens the streak is very indistinct. Specimens with a distinct streak resemble those of the unrelated *S. ochristriata* (Wlsm.); there are also some other undescribed, unrelated species with similar coloration and pattern. *S. confinis* is readily distinguished by features of male and female genitalia. In males, T8 (Fig. 255) is elongate-triangular with the apex lined with ventrally directed pegs, the uncus (Fig. 257) is cylindrical, the gnathos (Figs. 257, 258) has a very large, heavily sclerotized, blade-like basal projection and long, ventrally bent and apically hooked distal projection. In females, S7 (Fig. 342) medially has a shallow, medial through, has the caudal margin medially slit with a tuft of stiff, spiniform scales on each side of the slit and two small teeth inside the slit, the sterigma (Fig. 343) is a slender, subacuminate, obliquely striate cone. An undescribed, closely related species from Arizona and New Mexico has similar male and female genitalia but differs in having the uncus shorter than the tegumen (subequal in *S. confinis*), and the vinculum-valvae-aedeagus complex oriented obliquely to the right side of genitalia (oriented to the left in *S. confinis*).

Description. — Size. Forewing length 4.3-5.8 mm (mean = 4.8); hindwing length 3.9-4.6 mm (mean = 4.2); wing expanse 10.1-12.7 mm (mean = 10.9) (5 specimens).

Head. Face shiny olive-brown or dark brown, dirty white behind antennal sockets, clypeal area paler greyish in some specimens. Eyes relatively small, markedly narrower than frons. Haustellum base with whitish scales. Maxillary palpi conspicuous, folded over base of haustellum, greyish. Labial palpi extended to level of vertex, article 1 and basal half of 2 whitish, distal half of 2 and article 3 greyish-brown or grey suffused with brown. Antennae extended to about middle of forewings, grey-brown or olive-brown.

Thorax. Mesoscutum and collar medially brown or dark brown, laterally ochreous or whitish; in dark specimens, mesoscutum entirely dark brown. Tegulae golden-brown or olive-brown. Ventral surface whitish or pale greyish. Legs with outer side light or dark olive-brown, drab or greyish, tarsi darker; inner side whitish or light olive-brown.

Wings. Forewing elongate-lanceolate; upper surface brown, grey-brown or olive-brown with ochreous streak in fold extended from base to about middle or two-third of wing; streak indistinctly lined with darker brown in most specimens; streak indistinct in some specimens; apical portion of wing suffused with grey, ochreous or whitish in most specimens; ventral surface grey; cilia grey-brown. Hindwings with upper surface uniformly brown, ventral surface light brown or grey; cilia grey-brown. Venation as in *S. limbella* except as follow: forewing with basal fork of 1A+2A very short; hindwing with M2 and M3 separate, base of M2 free, M3, CuA1 and CuA2 very short, CuP absent; female frenulum with two bristles.

Abdomen. In males, upper surface dark grey or olive-brown with marked iridescence; ventral surface whitish; anal tufts grey. Terga and sterna (as seen in potash-cleared specimens) distinctly sclerotized; T3-T7 margined anteriorly, sterna unmargined. T8 (Fig. 255) modified, elongate-triangular, markedly sclerotized; lateral portions bent ventrad; anterior margin deeply V-emarginate; apical portion subpointed, margin lined with 12-14 small, ventrally directed pegs. S8

(Fig. 256) transverse, convex, antero-laterally with oval, smooth area; caudal margin medially with broad, U-shaped emargination. In females, upper surface with proximal two-thirds olive-brown or dark brown, markedly iridescent; distal third grey or grey-brown, lightly iridescent; ventral surface white or dirty white, apex greyish in some specimens.Terga and sterna (as seen in potash-cleared specimens) slightly or indistinctly sclerotized, unmargined. S7 (Fig. 342) suborbicular, medially with shallow groove anteriorly ended in very shallow, suborbicular invagination; posterior margin medially indented, folded inwardly, with tuft of stiff, spiniform scales laterad of indentation; indentation bicuspidate.

Male genitalia (Figs. 257, 258). Tegumen (Fig. 257) transversely narrow, anteriorly deeply V-emarginate, sides slightly convex, distal portion slightly constricted; pedunculi directed cephalad, right pedunculus longer than left one, rod-like. Uncus cylindrical, distally tapered, ventrally open, surrounding anal tube. Gnathos base fused to latero-ventral margin of tegumen, medially produced into massive, darkly sclerotized, caudally directed, chisel-like projection (Fig. 257); basal arm short, thick, partly recessed under tegumen; distal arm very long, situated baso-ventrally on projection, flat, sinuous, bent cephalad, apically recurved into hook, apex extended to level cephalad of genitalia. Vinculum (Fig. 258) somewhat spoon-shaped; paired arms attached to pedunculi (articulation seemingly fused), single arm broad, spatuliform. Valvae small, parallel, tapered rods basally fused to vinculum; apex with a few moderately long setae. Juxta as small, inconspicuous ridge ventrad of aedeagus, fused medially on vinculum. Aedeagus ankylosed to juxta-vinculum, small, somewhat bottle-shaped; distal half curved, narrowly tapered, spout-like. Bulbus ejaculatorius lenticular, about half size of genitalia, with small antero-lateral protrusion. Vinculum-valvae-aedeagus complex turned obliquely to left of genitalia (Fig. 258).

Female genitalia (Fig. 343). T8 as in *S. fissirostris* . S8 (Fig. 342) medially with narrow, longitudinal, indistinctly sclerotized area. Sterigma a slender, subacuminate, caudally pointed cone slightly longer than S8; base situated at anterior margin of S8; sides with fine, oblique striae. Ostium very small, at apex of sterigma. Ductus bursae very fine, membranous, delicate, inception about medially on bursa. Corpus bursae (Fig. 392) club-shaped, with anterior portion swollen; posterior apex abruptly narrowed into ductus seminalis. (Spermatheca not examined). Anterior apophyses thin, straight, divergent, slightly longer than S8. Posterior apophyses very thin, subequal in length to anterior ones, attached to small, light sclerite near anterior margin of T9+10. Ovipositor short, about 1.5x length of S8; papillae anales membranous.

Variation. — Specimens from Mendocino Co. have a darker brown upper surface than those from the type locality. No significant variation in external features other than that mentioned in the description was noted. Variation in features of genitalia was not examined.

Phylogenetic relationships. — See under *S. fissirostris* .

Geographical distribution and period of flight. — Known only from the type locality and from Mendocino Co. in northern California (Fig. 414). Adults have been collected in late May and are probably diurnal.

Hostplant. — Unknown.

3.3.27 *Scythris planipenella* (Chambers), status re-established

(Figs. 191, 260-262, 414)

Butalis plausipenella Chambers, 1875:10 [incorrect original spelling; see notes about synonymy below].

Butalis planipenella Chambers, 1875: 53 [justified emendation of *B. plausipenella* ; see notes about synonymy below].

Butalis planipennella [sic]; Chambers, 1878c:134 [unjustified subsequent emendation of *B. planipenella*, therein referred to as *B. plausipennella* (sic)].— Walsingham, 1888: 113.— Smith, 1891: 107 [checklist].

Butalis plausipennella [sic]; Chambers, 1878c: 134 [referenced list, misspelled reference to *B. plausipenella*].

Scythris planipennella [sic]; Dyar, 1902: 538 [catalogue].— Hodges *et al.*, 1983: 19 [checklist] [both citations as a synonym of *S. plausipennella*].

Scythris plausipennella [sic]; Dyar, 1902: 538 [catalogue].— Smith, 1903: 117 [checklist].— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist]. [misspelled reference to *S. plausipenella*].

Coleophora albacostella Chambers, 1875: 95.— Chambers, 1878a: 93 [partial description] and 1878c: 135 [referenced list].— Smith, 1891: 105 [checklist].— Dyar, 1902: 530 [catalogue].— Smith, 1903: 116 [checklist].— Barnes and McDunnough, 1917: 184 [checklist].— McDunnough, 1939: 94 [checklist].— McDunnough, 1944: 237 [cited as misplaced].

Scythris albacostella ; Hodges *et al.*, 1983: 19 [checklist]. **New synonymy.**

Coleophora fuscostrigella Chambers, 1878a: 93.— Chambers, 1878c: 133 [referenced list].— Smith, 1891: 106 [checklist].— Dyar, 1902: 532 [catalogue].— Smith, 1903: 116 [checklist].— Barnes and McDunnough, 1917: 185 [checklist].— McDunnough, 1939: 94 [checklist].— McDunnough, 1944: 237 [cited as misplaced].— Hodges *et al.*, 1983: 17 [checklist, cited as misplaced]. **New synonymy.**

Scythris hemidictyas Meyrick, 1928: 414.— Hodges *et al.*, 1983: 19. **New synonymy.**

Scythris hemidyctias [sic]; McDunnough, 1939: 91 [checklist, misspelled reference to *S. hemidictyas*].

Notes about synonymy. — In his 1875 paper, Chambers indicated on p. 53 that the name *Butalis plausipenella* associated with the description on p. 10 was misspelled (misprinted) and should be emended to *B. planipenella*. In a 1878 paper (p. 134), he made a further emendation of the name to *B. planipennella*, but under article 33 b(ii) of the Code, this subsequent emendation is unjustified. Actually, the latter emendation might be just another unwarranted misspelling, judging from the fact that the name *B. plausipennella* mentioned in Chambers' (1878c: 134) note is also misspelled!

Type material examined. —*Butalis planipenella* : HOLOTYPE male in MCZ, labelled: "Type/ 1517" [top white, rest red]; "Chambers" [printed]; "Tex." [printed]; "44" [handwritten]; "planipenella/ Chb." [handwritten]; "[male symbol] genitalia on/ slide no./ JFL-85-0289/ by J.F. Landry/ MCZ coll." [green, partly printed, partly handwritten, added by me]. Abdomen and genitalia dissected and mounted on slide no. JFL-85-0289.

Coleophora albacostella : HOLOTYPE male in MCZ, labelled: "Type/ 1580" [top white, rest red]; "Tex."; "74"; "albacostella Chb." [white, handwritten by Chambers]; "13/5"; "[male symbol] genitalia on/ slide no./ JFL-85-0288/ by J.F. Landry/ MCZ coll." [green, partly printed, partly handwritten, added by me].

Coleophora fuscostrigella : HOLOTYPE male in MCZ, labelled: "Type/ 1590" [top white, rest red]; "Tex." [printed]; "12/8" [very small, handwritten]; "87" [small, handwritten]; "SLIDE BW 182 [male symbol] No." [pale green, partly printed, partly handwritten, added by Barry Wright]; "fuscostrigella / Chambers" [white with black border, handwritten, added by Barry Wright]; "MCZ" [orange, typed]. The abdomen and genitalia were dissected, but the abdomen is missing and only the genitalia were mounted on slide no. BW 182; the 8th segment is separated from the genitalia. I remounted the slide, since the original mount was obscured by debris left attached to the genitalia. The name label on the type specimen is not Chambers' original, but *Coleophora fuscostrigella* is the name entered in the MCZ type notebooks under no. 1590, and thus it can be safely assumed that the association of the type specimen with that name is correct.

Scythris hemidictyas : Most of type material in BMNH and not examined. LECTOTYPE male designated by Clarke, 1965: 577. For notes about type material, see Clarke (*loc. cit.*).

PARALECTOTYPES examined, two males and one female (USNM), labelled as follow:

Male: "Forestburg/ Texas/ .7.27" [Meyrick's handwritten label]; "Comp. with type/ Scythris/ hemidictyas/ Meyrick/ Det. J.F.G.C. 1948"; "Scythris/ hemidictyas/ 22/13 Meyr./ E. Meyrick det./ in Meyrick Coll." [Meyrick's original determination label]; "[male symbol] genitalia on/ slide no./ JFL-83-1041/ by J.F. Landry/ in USNM coll." [green, partly printed, partly handwritten, added by me]; "Return to U.S. Nat. Mus." [yellow, printed, added by me].

Female: "Forestburg/ Texas/ .7.27" [Meyrick's handwritten label]; "Scythris/ hemidyctias [sic]/ Meyr../ AB Jun 1932" [handwritten in blue by Busck]; "Scythris/ hemidyctias [sic]/ Paratype Meyr" [handwritten in black by Busck]; "[female symbol] genitalia on/ slide no./ JFL-83-0391/ by J.F. Landry/ USNM coll." [green, partly printed, partly handwritten, added by me]; "Return to U.S. Nat. Mus." [yellow, printed, added by me].

Male: "Brenster [sic; =Brewster] Co./ Texas/ 8000 ft. .5.26" [printed]; "Scythris/ hemidyctias [sic]/ Paratype Mey." [handwritten in blue by Busck]; "Scythris/ hemidyctias [sic]/ Paratype Mey" [handwritten in black by Busck]; "[male symbol] genitalia on/ slide no./ JFL-84-0102/ by J.F. Landry/ in USNM coll." [green, partly printed, partly handwritten, added by me]; "Return to U.S. Nat. Mus." [yellow, printed, added by me]. In the original description, Meyrick mentioned 24 specimens from Forestburg collected in July and August, and one from Alpine (Brewster Co., Texas), collected at 8000 ft. in May: the latter appears to be the specimen mentioned here. Meyrick described it separately from the body of the main description as a slight color variant, but examination of the genitalia shows that it is *not* conspecific with the type from Forestburg but belongs to an undescribed, related species.

Clarke (*loc. cit.*) indicated that three specimens were missing from the Meyrick collection in the British Museum: two of these are probably the female and the male from Brewster Co. mentioned above. They do not bear Meyrick's original determination label but Busck labelled them as paratype, suggesting that he must have received them directly from Meyrick.

Type localities. —*Butalis planipenella* : Bosque Co., Texas.

Coleophora albacostella : Bosque Co., Texas.

Coleophora fuscostrigella : Bosque Co., Texas.

Scythris hemidictyas : Forestburg, Montague Co., Texas.

Recognition. — Adults are small-medium to medium-sized scythridids with pale cream-color or ochreous-brown ground color. The upper surface of the forewings has the coastal margin and veins clothed with paler scales than the rest of the wing surface so that the veins appear highlighted. Similar in color pattern to a few related, undescribed species occurring in the southern United States and northern Mexico. Adults of this group are distinguished from those of all Nearctic species by the long distal arm of gnathos which is bent at a right angle and extends cephalically beneath the male genitalia (Fig. 259). Adults of *S. planipenella* are distinguished from those of closely related species with similar male genitalia by the combination of an uncus distally tapered and curved leftward, distal projection of gnathos longer than genitalia (Figs. 259-260), and subequal halves of sternum 8 apically tufted with spiniform setae (Fig. 191).

Description. — The description is based mostly on males. The single female examined lacked the abdomen and genitalia. All specimens examined were in rather inferior condition for study and recognition.

Size. Forewing length 5.0-6.6 mm; hindwing length 4.3-5.7 mm; wing expanse 11.0-14.6 mm (2 specimens).

Head. Face cream-color-ochreous or grey-ochreous, with metallic lustre; neck tufts colored as face or white. Eyes large, very convex, bulged, about as wide as frons. Haustellum base with whitish or ochreous scales. Maxillary aplpi conspicuous, folded over base of haustellum, white. Labial palpi relatively long, upcurved, in most specimens extended to or above level of vertex; white or whitish except ventral surface of articles 2 and 3 mostly brown or olive-brown. Antenna extended to about two-thirds length of forewing, colored as face, ventral surface densely ciliate.

Thorax. Dorsal surface pale ochreous or grey-ochreous suffused with some cream-color. Ventral surface cream-color or white with metallic lustre. Legs with inner surface whitish or cream-color, outer surface mostly cream-color, pale ochreous or greyish-ochreous.

Wings. Frenum present. Forewing elongate-lanceolate, apex narrow, acute, termen almost straight; upper surface in some specimens with ground color cream-color with space between veins pale ochreous or very pale brown; in some specimens ground color pale olive-brown, in most specimens drab, pale ochreous-brown or grey-brown, with cream-color or whitish costal streak from base to apex, veins overlaid with cream-color, in some specimens indistinctly so and with distal half suffused with whitish, ochreous and drab; in some specimens with light metallic lustre; ventral surface drab or pale ochreous-brown; cilia cream-color or grey-ochreous. Hindwing narrowly elongate-lanceolate, apex acute, hind margin straight; upper and ventral surfaces pale grey, drab or brownish-grey, with light metallic hue; cilia pale ochreous or grey-ochreous.

Venation as in *S. limbella* except as follow: forewing with M3+CuA1 very obsolete, with indistinct pterostigma on costa between Sc and R2 (best seen on stained wings); hindwing with Sc+R1 to middle of costa, M2 and M3 separate, M2 twice length of M3, M3, CuA1 and CuA2 very short at posterior margin, female frenulum with two bristles.

Abdomen. [Color not seen because all specimens examined had the abdomen dissected. According to Meyrick's (1828: 414) original description of *S. hemidictyas* : "abdomen ochreous-whitish, ventrally whiter" but he did not indicate whether this applied to both sexes]. In males (as seen in potash-cleared specimens) terga and sterna 1-7 indistinctly sclerotized, terga anteriorly margined, sterna unmargined.

Male genitalia (Figs. 191, 259-262). Segment 8 (Fig. 191) markedly sclerotized, enlarged, strikingly modified. T8 elongate-subrectangular, extended above genitalia, anteriorly broadly U-emarginate; caudal margin asymmetrical, with row of stiff, spiniform setae bent rightward; right lateral angle protruded as irregularly shaped lobe with apical tuft of stiff, spiniform setae. S8 strikingly developed as T8, extended latero-ventrally over genitalia, separated into two valva-like, medio-ventrally articulated halves; each half with ventral margin distally sinuate, dorsal margin triangularly protruded and joined medially to T8, apical portion constricted, apex with tuft of stiff, spiniform setae. Genitalia (Figs. 259-262) deeply recessed within segment 8, compact, subglobular, asymmetrical. Tegumen asymmetrical, markedly convex, subhemispheric; in dorsal aspect (Fig. 262), left side laterally bulged, right side distally concave. Uncus ankylosed to tegumen, tooth-like (Fig. 259), in dorsal aspect apex abruptly tapered, asymmetrically curved leftward, heavily sclerotized, ventrally with few fine setae. Gnathos with base fused to tegumen (Figs. 260-261), skewed leftward; basal arms short, in lateral aspect their confluence caudally protruded into thickly sclerotized, blunt, tooth-like process (Figs. 259-260); process with fish-scales-like microsculpture; distal arm longer than genitalia, proximal fifth oriented ventrad, distal four-fifths bent at right angle, extended cephalad beyond anterior margin of tegumen and beneath abdomen between halves of S8, somewhat laterally compressed, apex with small, heavily sclerotized hook. Vinculum indistinct, as narrow, transverse band fused to base of valvae (Fig. 260). Valvae short, stubby, asymmetrical; left valva (Fig. 260) subsecuriform, apex with few fine setae; right valva (Fig. 259) basally broader and distally more tapered than left one, apex with few fine setae, costa medially with long, curved, digitate process protruded dorsad beyond level of basal process of gnathos. Juxta (?) small, twisted, triangular plate attached to inner dorsal wall of base of right valva. Aedeagus with base ankylosed to juxta, oriented obliquely to the right, apex almost abutted to digitate process of right valva; basal half cylindrical, distal half dilated, apex rounded; dorso-subapically with thin, sigmoid tube curved over aedeagus and with apex turned ventrad (Fig. 259); phallotreme at apex of thin sigmoid tube. Bulbus ejaculatorius ± lenticular, smaller than genitalia.

Female genitalia unknown.

Variation. — In the few specimens examined, ground color of upper surface of the body varies from cream-color in pale specimens to brownish in dark specimens. Male genitalia variy slightly in degree of convexity of T8, number of spiniform setae at apex of T8 and S8, degree of sinuation of ventral margin of S8 and width of apex of valvae.

Phylogenetic relationships. — See under *S. fissirostris* .

Geographical distribution and period of flight. — Known only from central Texas, in Bosque Co. and Forestburg, Montague Co. (Fig. 414). Specimens from Forestburg were collected in July.

Hostplant. — Unknown.

3.3.28 *Colinita sponsella* Busck, status re-established

(Figs. 52, 264-267, 344-346, 393, 412)

Colinita sponsella Busck, 1907: 139.

Scythris sponsella ; Walsingham, 1909: 52.— Barnes and McDunnough, 1917: 189 [checklist].— McDunnough, 1939: 91[checklist].— Hodges *et al.*, 1983: 19 [checklist].

Notes about synonymy. — Walsingham (1909) synonymized the monobasic genera *Colinita* and *Arotrura* (see following taxon) with *Scythris* on the basis of veins R4 and R5 of the forewing stalked with R4 extended to costa and R5 to termen in all three groups, but this appears to be a character state of the family. *Colinita* and *Arotrura* are markedly distinct in structure of male genitalia from the type species of *Scythris* and from one another, hence I regard their generic status as valid and list the included species, *C. sponsella* and *A. eburnea*, accordingly. These genera will be treated more fully in Chapter 4.

Type material examined. — HOLOTYPE female in USNM, labelled: "Yuma Co. Ariz./ Desert" [white, printed]; "Type/ No. 10324/ U.S.N.M." [red, printed except number handwritten]; "Colinita/ sponsella/ Type! Busck" [white with black border, handwritten by Busck]; "[male symbol] genitalia/ on slide/ AB May 23 1927" [label similar to preceding]. The specimen has been dissected by Busck and its abdomen and genitalia are on a slide labelled "Colinita/ sponsella/ Type Busck/ Yuma Co Ariz/ AB May 23 1927" and, on a second label "[female symbol]"; I have drawn a red line around the word "Type" to make it more conspicuous. The right wings have also been removed and dry-mounted by Busck on a slide labelled "Colinita/ sponsella/ Busck/ Type of genus/ + species/ Yuma Co Ariz." and on a second label "Type of sp/ + genus/ AB 1907"; the word "Type" on both labels was encased in a red border by me; the forewing's apical half and the entire hindwing are denuded. The holotype is a female in spite of Busck's slide label indicating that it is a male.

Type locality. — Yuma Co., Arizona

Recognition. — Adults are large scythridids with upper surface of forewings white with dense olive-brown suffusion forming just before middle a jagged, oblique fascia preceded by a more or less immaculate area and, in apical third, fine, more or less distinct lines or streaks (Fig. 52). The first abdominal tergum is mostly devoid of scales with the integument black. Females have the rest of the abdomen characteristically ochreous-yellow. Specimens of *C. sponsella* somewhat resemble those of other undescribed species and of *S. divaricata* in pattern of forewings, but in the latter ground color is grey and/or the transverse fascia, white (Figs. 53-54). Adults of both sexes of *C. sponsella* can be readily distinguished from those of all other Nearctic scythridids by features of genitalia. In males, tergum 8 (Figs. 266-267) is markedly enlarged and distally finger-shaped, the lateral portion of tegumen are rather narrow, subcrescentic, the uncus is composed of two short, digitate arms, the valvae are asymmetrical and not ornate, and the aedeagus is distally sigmoid (Figs. 264, 267). In females, the horseshoe-shaped sterigma and ostium are recessed under a tongue-like, caudal protrusion of sternum 7 (Figs. 345-346) and the bursa is very large and U-bent (Fig. 393).

Description. — Size. Forewing length 8.5-9.5 mm (mean = 9.1); hindwing length 7.1-8.2 mm (mean = 7.7); wing expanse 18.5-20.6 mm (mean = 19.6) (10 specimens).

Head. Face and neck-tufts dull white suffused with olive-brown. Eye relatively large, bulbous, amost as wide as frons. Haustellum base clothed with white scales, in some specimens scatteringly suffused with olive-brown. Maxillary palpi relatively long, conspicuous, folded over base of haustellum, apices contiguous. Labial palpi upcurved, extended to, or slightly beyond, level of vertex; article 1 white, article 2 white with ventral side of distal half olive-brown, article 3 white with ventral side of medial third olive-brown. Antenna long, filiform, extended to about three-quarters of forewing length; dorsally with basal quarter to third white with scattered olive-brown suffusion, distal two-thirds to three-quarters drab or light tan with light golden metallic lustre; scape ventrally with dense pecten of white, hair-like scales; flagellum ventrally finely ciliate.

Thorax. Dorsal surface, on mesothorax white densely suffused with olive-brown, on metathorax with few white scales. Ventral surface mostly shiny white with light bluish or iridescent hue, lateral portions of mesothorax with olive-brown and, in some females, with some yellowish. Legs with trochanters mostly white, femurs and tibiae white with outer side variously suffused with olive-brown, tarsi mostly olive-brown with white suffusion; hind tibia with hair tuft white, drab or white mixed with drab or olive-brown.

Wings. Frenum absent. Forewing very lanceolate, apex acute, termen slightly sinuate; dorsal surface white densely suffused with olive-brown; in most specimens olive-brown scales coalesced before middle into irregular, jagged, obliquely transverse fascia, medial area basad of fascia nearly white or with very scattered dark suffusion (Fig. 52); distal half with dark suffusion arranged in fine, indistinct longitudinal lines or streaks; ventral surface in males drab with costa whitish, with pale golden metallic lustre, in females pale yellowish with similar lustre; cilia drab mixed with some white. Hindwing broadly lanceolate, apex pointed, termen slightly sinuate, costa bulged in basal third; dorsal surface in males with pale golden metallic lustre and faint iridescence, proximal two-thirds dirty white, distal third very pale brown or drab; in females pale yellow with faint metallic lustre; ventral surface in males very pale drab with some white and light metallic lustre, in females colored as dorsal surface; cilia in males pale drab, in females pale yellow. Venation as in S. limbella except as follow: forewing with Sc to costa before middle, M2, M3 and CuA1 double-stalked; female frenulum in most specimens with two short, closely appressed bristles, in some specimens with single short bristle.

Abdomen. T1 unscaled, tegumen black, medially with faint flavescent area. In males T2-T7 white or greyish-white with metallic lustre and slight iridescent hue; T8 with long, hair-like scales; ventral surface white, T1-T7 with dense olive-brown suffusion and moderate iridescent hue. In females T2-T7 ochreous-yellow with moderate or marked iridescent hue; in some specimens T7 and anterior portion of T6 paler whitish-yellow; scales of T2-T4 and of basal two-thirds of T5-T6 broadly elongate-truncate, scales of caudal margin of T5-T6 and of most of T7 narrowly elongate and pointed, those of T5-T6 extended beyond caudal margin and forming dense, raised, comb-like row; S1-S3 whitish with scattered olive-brown suffusion, S4-S5 mostly drak olive-brown with some whitish suffusion and marked iridescent hue, S6-S7 whitish or yellowish mixed with drab or pale olive-brown and with moderate or marked iridescent hue. In males (as seen in potash-cleared specimens), T2 markedly sclerotized, T1 and T3-T7 indistinctly sclerotized or membranous, with fine anterior margin; sterna unmargined, moderately sclerotized, S2 ± rhomboid, S6-S7 medially membranous, S8 reduced, very small, indistinct. In females, terga and sterna 2-5 lightly to moderately sclerotized, terga with fine anterior margin, sterna unmargined; sclerotized area of S1 contiguous with anterior apodemes; sclerotized area of S2 very small; segment 6 well sclerotized, T6 transversely rectangular, S6 subquadrate, anteriorly margined, antero-lateral angles markedly prolonged into curved lamina with apex tapered and extended dorsad on T6 as anterior margin (Fig. 344).

Male genitalia (Figs. 264-267). Proportionally large in relation to abdomen, somewhat asymmetrical, basal half recessed within segment 7. T8 (Figs. 266-267) markedly enlarged and sclerotized, caudal half narrow, digitate, slightly sinuate; in dorsal aspect (Fig. 266), anterior half V-shaped, with apical portion of arms free and braced above tegumen; medially with lateral, pointed protuberance; pleurum expanded into broad, membranous lobe extended to half of digitate projection of T8, with hair-like scales. Intersegmental membrane between T8 and tegumen expanded, moderately sclerotized, dome-like, extended from base of tegumen to apex of socii, and fused medially to lateral protuberances of T8. Tegumen (Figs. 264, 267) narrow, arch-like, dorso-medially with deep anterior emargination dividing tegumen into two halves; in lateral aspect (Fig. 267) each half subcrescentic. Uncus absent. Socii (Fig. 264, 267) as two short, incurved, finely setose, digitate processes. Gnathos wishbone-like, distal arm twice length of basal ones, asymmetrically skewed rightward, apically hooked. Vinculum (Fig. 265) projected caudad, flap-like with rounded caudal margin, anterior margin medially broadly produced cephalad. Valvae elongate, asymmetrical, basally fused to antero-medial projection of vinculum and movable as single unit along dorso-ventral axis, proximal half of costa with row of fine setae; right valva digitate, simple, distally tapered and slightly curved; left valva slightly longer than right one, distal third with rounded protuberance on costa, apical portion tapered. Juxta fused ventrally to submedial part of aedeagus and articulated medially to margin of anterior projection of vinculum. Aedeagus ankylosed by juxta, recessed cephalad of tegumen into fold of upper diaphragma; tubular, in lateral aspect base moderately dilated, apical third abruptly bent ventrad and sigmoid, phallotreme opened ventrally. Bulbus ejaculatorius as small, membranous flap.

Female genitalia. T7 elongate-rectangular, antero-lateral angles extended as laminae curved caudad and articulated with antero-lateral corners of S7. S7 (Figs. 345-346) elongate, linguiform; apical third projected above basal portion of S8, markedly thickened, rounded, medio-apically with small, membranous, lobate appendix. T8 elongate, about half length of T7, caudal half bilobate, lightly sclerotized, with few scattered fine setae. S8 transverse, about half length of T8, very slightly sclerotized, medially membranous, latero-apically with few scattered fine setae. Sterigma horseshoe-shaped, situated at anterior end of intersegmental membrane between S7 and S8, recessed under projected distal portion of S7. Ostium small, in middle of sterigma, oriented dorsad. Ductus bursae fine, membranous, inception at one end of bursa. Corpus bursae (Fig. 393) extremely large, almost filling abdominal cavity, very elongate, sausage-like, submedially U-bent, longer portion broader, medially dilated and apically abruptly narrowed into ductus seminalis. Spermatheca not examined. Anterior apophyses long, thin, parallel or slightly divergent, extended to anterior margin of T7. Posterior apophyses about 1.5x length of anterior ones. Ovipositor moderately long, about 0.20x length of T1-T7; papillae anales membranous.

Variation. — No significant variation was observed in external features of specimens examined. In the original description, Busck (1907) indicated that ground color of forewings was dirty white but this must be due to discoloration of the holotype. All relatively fresh specimens examined have forewings with white ground color. Variation in genitalia was not examined.

Phylogenetic relationships. — *C. sponsella* is the only known member of *Colinita* . It is not related to *Scythris s. str.* but belongs with *Arotrura eburnea* to a different section of the family comprising mostly undescribed taxa, whose member taxa lack a frenum (plesiomorphic feature) and have, in males, a markedly developed tergum 8 with concomittantly reduced sternum 8 and, in females, a lobate membranous appendix at the caudal margin of S7 (apomorphic features).

Geographical distribution and period of flight. — Known to range in the Sonoran deserts of southern California, Arizona, New Mexico and Baja California (Fig. 412). Adults occur from early March (later at higher elevations) to late May. They are nocturnal and have been collected at light.

Hostplant. — Unknown.

3.3.29 *Arotrura eburnea* Walsingham, status re-established

(Figs. 49-50, 157, 277-281, 362-364, 399, 413)

Arotrura eburnea Walsingham, 1888: 117.— Smith, 1891: 107 [checklist].— Smith, 1903: 118 [checklist].

Arotura [sic]*eburnea* ; Dyar, 1902: 544 [catalogue, misspelling of *Arotrura*].

Scythris eburnea ; Walsingham, 1909: 51.— Busck, 1909: 97 [discussion of generic synonymy].— Barnes and McDunnough, 1917: 189 [checklist].— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist].

Notes about synonymy. — See "Notes about synonymy" under *Colinita sponsella* .

Type material. — Type material in BMNH and not examined. According to Walsingham (1888: 117), the original type series included two males and one female. Powell (pers. comm., 1984) photographed the holotype, which is a female.

Possible SYNTYPE: I examined a male in USNM with original Walsingham's labels as follow: "[male symbol]"; small green circle with nothing written on it; "33/ 1889/ WLSM. COLL." [numbers handwritten, rest printed pale purple with similarly colored double border]; "Morrison/ Arizona/ 1881." [white, printed]; "Arotrura/ eburnea/ Wlsm" [in Walsingham's handwriting]; "[male symbol] genitalia/ on slide/ AB May 4 1926" [handwritten by Busck]. Since Walsingham mentioned that the material upon which he based his description was collected by H.K. Morrison in Arizona, this specimen is possibly a syntype. Confirmation of its status must await examination of the type material in BMNH to ascertain whether one of the three specimens mentioned by Walsingham is missing.

I also examined a male homotype selected by J.A. Powell (UCB).

Type locality. — Arizona, as given by Walsingham.

Recognition. — Adults are large to very large, stout, immaculate, ivory-white scythridids (Figs. 49-50). In coloration specimens of *A. eburnea* resemble those of a few undescribed, unrelated species (*e.g.* Fig. 51), most of which have some ochreous or brown suffusion on the forewings. *A. eburnea* is readily distinguished from all other Nearctic scythridids by features of male and female genitalia. In males T8 is greatly developed and plow-like in lateral aspect (Fig. 281), the membrane between T8 and the tegumen is markedly sclerotized, medially humped and laterally protruded into ventrally directed flanges bracing the base of uncus (Fig. 277), the aedeagus is large, heavy, tubular and surrounded by a sclerotized, inpocketed portion of the diaphragma attached to its anterior end (Figs. 277, 279). In females, S7 (Fig. 362) is medio-longitudinally grooved, the sterigma is membranous and the distal portion of ductus bursae is widened into a lightly sclerotized, sigmoid antrum (Fig. 364).

Description. — Size. Forewing length 9.5-10.5 mm (mean = 10.1); hindwing length 8.4-9.5 mm (mean = 8.9); wing expanse 20.7-23.0 mm (mean = 22.1) (8 specimens).

Head. Face and neck tufts ivory white. Eyes large, globulous, almost as wide as frons. Haustellum almost as long as body, extreme base with ivory white scales. Maxillary palpi small, conspicuous, folded over base of haustellum. Labial palpi relatively long, extended to or above level of vertex, ivory white; in some specimens, distal portion of article 2 and article 3 lightly suffused with testaceous; article 1 ventrally tufted. Antenna filiform, long, extended to two-third of forewing length, dorsally ivory-white; scape ventro-basally compressed, with ventral pecten of scales as long as article; flagellum ventrally densely ciliate.

Thorax. Dorsal and ventral surfaces ivory white. Legs long, very slender, ivory white, in some specimens proximal half of fore- and midleg with slight testaceous tinge.

Wings (Fig. 157). Frenum absent. Forewing elongate-lanceolate, apex acute, very slender, termen sinuate; upper surface ivory white; ventral surface pale testaceous or pale grey-brown; cilia ivory white (Figs. 49-50). Hindwing broadly elongate-lanceolate, apex acute, termen sinuate; upper and ventral surfaces yellowish-white, pale testaceous or greyish-yellow; cilia pale yellowish or pale testaceous; female frenulum with two bristles. Venation (Fig. 157) as in *S. limbella* except as follow: forewing with both M3 and CuA1 present, forked or short-stalked, M2 base proximate to or forked with M3-CuA1 fork; hindwing with CuP absent.

Abdomen. In males, entirely ivory white; T8 with tuft of hair-like scales as long as tergum; T1-T4 (as seen in potash-cleared specimens) indistinctly sclerotized, T5-T6 medially with narrow, longitudinal sclerotized area, T2-T6 anteriorly finely margined; sterna unmargined; S2-S6 distinctly sclerotized, subquadrate or transverse, medially divided on S3-S6; S7 membranous; S8 sclerotized, transversely rectangular, very small, pleural area with small crescentic sclerite. In females, dorsal surface with light iridescent hue, T1-T5 light brown, T6-T7 yellowish-white; ventral surface ivory white except lateral portion of S2-S4 light brown and apex of S7 pale yellowish; terga and sterna (as seen in potash-cleared specimens) distinctly sclerotized, markedly sclerotized on segments 6-7; T3-T6 anteriorly slightly margined; sterna unmargined; T6 transversely rectangular, medially with longitudinal crease clothed with very firmly attached scales, caudal margin medially with apically bifid conical invagination; T7 elongate, subcampaniform, slightly convex, anterior margin medially produced into triangular, truncate flap inserted into invagination of T6, caudo-medially with oval fovea clothed with very firmly attached scales (Fig. 363); S7 very broad and convex, transverse, medially divided by deep longitudinal groove prolonged beyond posterior margin into membranous, prominent lobe (Fig. 362); membrane between segments 7 and 8 almost as long as S7.

Male genitalia (Figs. 277-281). Symmetrical, proportionally very large in relation to abdomen. T8 greatly developed, markedly sclerotized; in dorsal aspect (Fig. 280), anterior half somewhat V-shaped, with arms extended laterad of tegumen, medially with lateral protuberance, distal half narrow, rod-like; in lateral aspect (Fig. 281), medially with heavy ventral projection, distal half plow-like; medio-lateral protuberances ventrally prolonged into narrow lamellae fused laterally to membrane between T8 and tegumen. Intersegmental membrane enlarged, thickly sclerotized, extended over tegumen, produced medially above base of socii into dome; dome ventro-laterally produced into broad flanges bracing base of socii (Fig. 277). Tegumen markedly arched, broadly crescentic in lateral aspect (Fig. 277), anterior margin dorso-medially with deep, broad V-emargination (Fig. 278). Uncus absent. Socii long, rod-like, proximal half downcurved, parallel, distal half straight, pointed caudad, slightly divergent, sparsely setose (Figs. 277-278). Gnathos relatively small, delicate, wishbone-like, distal arm shorter than proximal ones (Fig. 277). Vinculum inconspicuous, reduced to very narrow, crescentic rim fused to base of valvae (Fig. 279). Valvae with base transversely fused, deeply U-emarginate to about one third length of valvae (Fig. 279); inner side concave; ventral margin medially with incurved flap; distal third tapered; costa medially with large, inwardly setose cucullus. Juxta seemingly absent. Aedeagus relatively large, tubular, slightly upcurved, about half length of genitalia (Fig. 279), latero-distally with two or three small, blunt teeth; latero-dorsally with longitudinal "window" extended from base to nearly apex; aedeagus ankylozed by moderately sclerotized, invaginated lower diaphragma attached around base and extended beneath as deep trough (Figs. 277, 279). Bulbus ejaculatorius undeveloped.

Female genitalia. T8 very indistinctly sclerotized, apical margin with fine setae. S8 distinctly sclerotized, elongate, caudal half subquadrate, apical margin indistinct with fine setae; anterior half gradually narrowed cephalad, fishtail-like, partly overlapped by sterigma, surface with fine pointed microsculpture and with scattered fine setae (Fig. 364). Sterigma as membranous, semi-rigid, broad, short, truncate cone, situated at anterior margin of S8. Ostium at apex of sterigma, pointed caudad, almost as wide as sterigma cone, oval (Fig. 364). Ductus bursae with proximal half widened into antrum, antrum curved leftward, slightly sclerotized; anterior half of ductus membranous, narrow,twisted or bent just cephalad of antrum, inception into anterior end of bursa. Corpus bursae (Fig. 399) very large, almost as long as abdomen, anterior two-thirds elongate, subellipsoid, distal third moderately narrowed into tubular ductus seminalis. Spermatheca not examined. Anterior apophyses straight, subparallel, attached latero-medially on T8, about 1.5x length of T8. Posterior apophyses slightly thinner than and about 1.5x length of anterior ones. Ovipositor about 0.40x length of T1-T7, papillae anales membranous or lightly sclerotized.

Variation. — No significant variation was noticed in specimens examined.

Phylogenetic relationships. — This species forms a monobasic genus based on autapomorphic shape and fusion of male T8, dome-shaped intersegmental membrane with ventrally projected flanges bracing the socii, and sclerotized lower diaphragma ankylozing the base of aedeagus. *Arotrura* is closely related to an undescribed genus comprising several undescribed species occurring in the southwest and both genera belong to the same major lineage of the family as *Colinita*.

Geographical distribution and period of flight. — Known to range in the deserts of Arizona, New Mexico and westernmost Texas (Fig. 413). Strangely, the species has not been found in southern California despite relatively extensive collecting. Adults occur from early May to mid-July, and from early September to early October. They probably have two generations per year at least in some parts of the range, as suggested by collections of adults made in early June and early October at one locality in Yavapai Co., Arizona. Adults are nocturnal and have been collected at light.

Hostplant. — Unknown.

3.3.30 *Scythris divaricata* Braun

(Figs. 53-54, 158, 285-288, 353, 396, 420)

Scythris divaricata Braun, 1923a: 121.

Type material examined. — HOLOTYPE male in CAS, labelled: "Angeles Bay/ Gulf Calif./ May 4 1921" [white, printed]; "EPVan Duzee/ Collector" [white, printed]; "Scythris/ divaricata/ Holotype Braun" [white, handwritten]; "[male symbol] genitalia on/ slide no./ JFL-84-0229/ by J.F. Landry/ in CAS coll." [green, partly printed, partly handwritten; this label was added by me]"; "HOLOTYPE" [red, printed, added by me]; "Collection of the/ California Academy/ of Sciences San/ Francisco, Calif." [white with a red cross stripe, printed]. The abdomen and genitalia were dissected by me and mounted on slide no. JFL-84-0229. In the original description, Braun indicated that the type was [CAS] no. 982, but no such indication can be found on the labels affixed to the holotype.

PARATYPE, two males (ANSP, CAS), with same data as holotype except collecting date "Jun. 25 1921" (ANSP) and "May 4 1921" (CAS). The ANSP specimen also bears a small red label marked "Paratype" in Braun's handwriting.

Type locality. — Angeles Bay, Lower California, as given by Braun (= Bahía de los Angeles, Baja California Norte, México).

Recognition. — Adults are slender, medium-large to large scythridids with upper surface of forewings in most specimens having a peppery appearance from white or whitish ground color very densely suffused with brownish or dark grey-brown (Figs. 53-54). The dark suffusion is mostly from scales with a white or pale base and a dark tip. In most specimens the forewings have a white, zigzagged, oblique fascia in the basal third which, in many, is lined on one or both sides with dark scales. A few specimens have white forewings with a few small, dark brown spots. In color, pattern of forewings and aspect of genitalia, adults of *S. divaricata* resemble those of *S. oxyplecta* and of several other undescribed, related species from the american southwest. They are best separated from them by the latero-apically dentate T8 of male genitalia (Fig. 288). Females of several of the undescribed species have genitalia similar to those of *S. divaricata* and characters for their reliable separation are not known at present.

Description. — Size. Forewing length 6.4-10.5 mm (mean = 8.6); hindwing length 5.9-9.1 mm (mean = 7.6); wing expanse 14.2-23.0 mm (mean = 18.9) (15 specimens).

Head. Face and neck tufts in many specimens white or whitish suffused with brown-tipped, drab or ochreous scales; in some specimens white with some brown or drab in occipital area; in few specimens entirely white. Eye bulbous, medium and slightly narrower than frons, to large and wider than frons. Haustellum base with white scales. Maxillary palpi conspicuous, folded over base of haustellum. Labial palpi upcurved, relatively long and extended above level of vertex, in most specimens white with medio-ventral portion of articles 2 and 3 ± diffusely ringed with brown or dark brown, in few specimens white except distal half of articles 2 and 3 with small brown patch on outer side. Antenna extended to about two-thirds of forewing, filiform; scape, pedicel and basal articles of flagellum white suffused with drab, rest of flagellum drab; in some specimens basalmost portion of antenna white, rest ochreous; scape moderately dorso-ventrally compressed, with dense, long pecten of 15-20 piliform scales; ventral side of flagellum densely ciliate in males, moderately so in females.

Thorax. Dorsal surface in most specimens white variously suffused with drab, dark brwon-tipped, greyish and tan scales; in few specimens, almost entirely white except tegulae suffused with some drab- or brown-tipped scales. Ventral surface in most specimens snowy white with light reddish-iridescent hue, in few specimens pale yellowish with same hue; in some specimens area below tegula with some drab. Legs in dark specimens white densely suffused with dark brown-tipped, drab or olibe-brown scales, in pale specimens mostly white with very scattered suffusion of brown-tipped scales and distal portion of tarsi dark brown or olive-brown.

Wings (Fig. 158). Frenum absent. Forewing elongate-lanceolate, apex pointed, termen straight; upper surface in dark specimens appearing predominantly grey, grey-brown or brownish sufffused with white (dark color resulting from scales with pale base and dark tip); in most specimens white scales forming oblique, zigzagged fascia in basal third, in many specimens distal third with samll, ± indistinct dark spot; in intermediately colored specimens, upper surface colored as in dark specimens but appearing predominantly white or whitish with dark-colored suffusion, zigzagged white fascia diffusely lined with dark scales, dark spot of distal third distinct, in some specimens two short, dark, costal streaks near apex; in pale specimens upper surface mostly white with scattered dark suffusion, in some specimens with diffuse zigzagged dark fascia in basal third; in palest specimens surface white with 2-3 small dark spots in basal third, one in apical third and two short costal streaks near apex; ventral surface in dark specimens ochreous-grey, distal half of costa pale ochreous or whitish, in some specimens apical portion cream-color or pale ochreous; in pale specimens ventral surface ochreous-whitish; cilia white mixed with some drab and pale yellowish. Hindwing broadly lanceolate, apex acute, termen sinuate; upper surface in dark specimens pale whitish-drab, in pale specimens pale yellowish-white; ventral surface colored as dorsal surface; cilia pale ochreous. Venation (Fig. 158) as in *A. eburnea* . Female frenulum with two bristles.

Abdomen. Males with dorsal surface uniformly pale yellowish-white; ventral surface of pale specimens white with very scattered tan or brown scales, dark specimens white with moderate to dense dark brown suffusion; T1-T7 moderately sclerotized, with fine anterior margin; S2-S3 moderately sclerotized, S4-S7 markedly sclerotized, unmargined. Females with dorsal surface in dark specimens with T1-T2 whitish, other terga yellowish, progressively darker toward apex; few specimens with T7 with few brown-tipped scales; pale specimens with dorsal surface entirely pale yellow; ventral surface of dark specimens white with dense brown and ochreous suffusion and slight iridescent hue; some specimens with most of S3-S5 dark brown; in pale specimens, white with scattered brown-tipped scales; terga and sterna 1-6 as in males; segment 7 markedly sclerotized; T7 elongate rectangular; S7 broadly elongate, medially with broad, shallow concavity, caudal margin rounded with medial emargination, membrane of emargination caudally prolonged into small, lobate appendix (Fig. 353).

Male genitalia (Figs. 285-288). Symmetrical. T8 (Fig. 288) markedly sclerotized, modified, fused to tegumen, elongate, hood-like in dorsal aspect, apex truncate or subtruncate, with lateral angles dentiform or spiniform. S8 unmodified, small, about half size of S7, semicircular. Tegumen (Figs. 285-286) shaped somewhat as in *A. eburnea* but more rounded anteriorly and with more concave posterior margin. Socii thickly sclerotized, dorsally horned in lateral aspect (Fig. 285) and with dense erect setae projected cephalad, latero-ventrally setose, apex deeply notched (Fig. 286), dors-medial area concave with several small pits (Fig. 286). Gnathos as in *A. eburnea* . Vinculum ± as in *A. eburnea* , reduced to very narrow, transverse rim fused to base of valvae (Fig. 287). Valvae basally fused together, almost straight, distally convergent with apices subcontiguous (Fig. 286); costa with proximal half broad, explanate, forming transverse, setose surface, with outer margin basally elevated; costa subapically toothed, in lateral aspect apex of valvae appearing obliquely truncate (Fig. 285). Juxta as thick bar almost as long as aedeagus, articulated dorso-medially on base of valvae and distally fused to bulbous base of aedeagus (Figs. 285-287); diaphragma invaginated within tegumen, sclerotized along juxta and around base of aedeagus. Aedeagus narrow, elongate, tubular, slightly upcurved, with bulbous base (Fig. 285); bulbus ejaculatorius undeveloped.

Female genitalia (Figs. 353, 396). T8 laterally indistinctly sclerotized, with coarse, spinulate microsculpture. S8 membranous, microsculptured as T8. Sterigma (Fig. 353) on anterior margin of S8, elongate, in dorsal aspect digitate, in lateral aspect dorso-ventrally compressed with apex spout-like; sides membranous, dilated, with 1-2 setae; dorsal wall antero-laterally prolonged into curved, invaginated apodemes. Ostium very broad, ventral and subapical on sterigma, laterally with few setae. Ductus bursae membranous, distal portion wide, inception medio-laterally on bursa. Corpus bursae (Fig. 396) elongate, ovoid, caudally abruptly narrowed into ductus seminalis. (Spermatheca not studied). Anterior apophyses straight, parallel, about 3x length of T8. Posterior apophyses thinner and barely longer than anterior ones. Ovipositor relatively short, about 0.20x length of T1-T7; papillae anales densely setose, apically notched, membrane stiff with lateral portion around attachment of posterior apophyses slightly sclerotized.

Variation. — Adults of *S. divaricata* are greatly varied in size and coloration, mostly in coloration of upper surface of forewings. Most specimens examined have a whitish ground color densely mixed with dark grey or brownish-grey (mostly from dark-tipped scales) and have a peppery appearance, with the oblique, zigzagged white fascia distinct and lined with dark scales (Fig. 53). In some specimens the dark suffusion is more scattered and the forewings appear predominantly whitish with indistinct or irregular brownish streaks. Some specimens have predominantly grey forewings suffused with some white and without distinct zigzagged fascia (Fig. 54). A few specimens have almost entirely white forewings with only a few small, dark spots.

In size the largest specimens examined are about twice as large as, and have about twice the wingspan of, the smallest. No significant variation was observed in the genitalia of males from different parts of the range. Variation in female genitalia was not examined.

Phylogenetic relationships. — This species is not a *Scythris s. str.* but belongs to a distinct genus with several undescribed species distributed mostly in arid parts of the american southwest. The only other closely related species that is described is *S. oxyplecta* Meyrick (see below).

Geographical distribution and period of flight. — This species was not previously mentioned in any of the checklists and catalogues of North American Lepidoptera because it was described from Mexico and has remained unrecognized until now. It is known to occur in southern California, southern Utah, Colorado, Arizona, New Mexico and Baja California (Fig. 420). Adults have been collected from late March to mid-August. One specimen from Phoenix, Arizona was obtained in October, and two specimens from Fresno Co., California were collected in early February. Large series were collected in July and early August in New Mexico and California. Adults are nocturnal and have been collected at both black and white lights.

Hostplant. — Unknown.

3.3.31 *Scythris oxyplecta* Meyrick

Scythris oxyplecta Meyrick, 1916: 14.— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist].

Type material. — LECTOTYPE female in BMNH, designated by Clarke, 1965: 578, and not examined. For notes about type material, see Clarke, *loc. cit.*

Type locality. — Florida, as given by Meyrick.

Notes about identity. — Partial interpretation of the name is tentatively based on comparison of specimens with photographs of the lectotype wings and genitalia provided in Clarke (1965: 578, plate 282, figs. 4a-c). The illustrations show the species to be probably related to *S. divaricata* Braun based on color pattern of the forewing and shape of sterigma of female genitalia, but are too nebulous to allow assessement of specific details. Confirmation of specific identity will require examination of the lectotype. Females of species belonging to the *S. divaricata* complex are very difficult to distinguish without careful examination of genitalia. It is unfortunate that the only male paralectotype is without abdomen because examination of male genitalia would greatly facilitate recognition.

I examined a male and a female (USNM), both doubtfully identified as *S. oxyplecta* . They are labelled as follows:

Male: "Brenster [sic; =Brewster] Co./ Texas/ 7000 ft. .4-26" [Meyrick's printed label]; "Scythris/ oxyplecta/ Paratype Meyr AB Jun 1932" [Busck's label, handwritten in blue and folded in two]; "Scythris/ oxyplecta/ Paratype Meyr" [Busck's label, handwritten in black, with black border lining, folded in two]; "[male symbol] genitalia/ on slide/ AB Dec 11 1933" [handwritten by Busck, contour thinly lined with black]; "ab 148" [pale green, typed, added by me for easier reference to the slide]; "Return to/ U.S. Nat. Mus." [yellow, printed, added by me]. Contrary to the statement on Busck's labels, this male specimen is *not* a paratype, nor even a syntype. Meyrick (1916: 14) described the species based only on two specimens from Florida. Identity of the male from Brewster Co. is uncertain but is possibly conspecific with the female specimen discussed below.

Female: "Brenster [sic; =Brewster] Co./ Texas/ 8000 ft. .5-26" [Meyrick's label, printed]; "Comp. with type./ Scythris/ oxyplecta/ Meyrick/ Det. J.F.G.C. 1948" [Clarke's label]; "Scythris/ oxyplecta/ 22/13 Meyr./ E. Meyrick det./ in Meyrick Coll."; "Return to/ U.S. Nat. Mus." [yellow, printed, added by me]. The abdomen is detached and placed in a gelatin capsule pinned under the specimen. The identification was based on external features because the specimen is undissected; conspecificity cannot be confirmed without comparison of genitalia with those of the lectotype.

Recognition. — Adults are probably somewhat similar to those of *S. divaricata* Braun in habitus, color pattern of forewings and shape of sterigma: body slender, forewings greyish with an irregular, somewhat jagged, whitish, oblique streak in basal third, sterigma as a cylindrical projection with a wide, ventro-subapical ostium. See Clarke 1965: 578, plate 282, figs. 4a-c.

Description. — No detailed description can be given at present because no specimens determined with certainty as belonging to this species were examined.

Phylogenetic relationships. — Shape of the sterigma of females suggests that this species is related *S. divaricata* Braun.

Geographical distribution and period of flight. — Known with certainty only from the type series from Florida, which was collected in June (Meyrick 1916: 14). I have seen no other specimen assignable to the *S. divaricata-S. oxyplecta* complex other than the types of *S. oxyplecta* have subsequently been collected in Florida, but *S. divaricata* and several undescribed related species occur commonly from Texas westward.

Hostplant. — Unknown.

3.3.32 ***Nomina dubia***

3.3.32.1 ***Scythris albilineata*** **(Walsingham)**

Butalis albilineata Walsingham, 1888: 116.— Smith, 1891: 107 [checklist]. ***Nomen dubium.***

Scythris albilineata ; Dyar, 1902: 537 [catalogue].— Smith, 1903: 117 [checklist].— Barnes and McDunnough, 1917: 189 [checklist].— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist].

Type material. — In BMNH and not examined. According to Walsingham (1888: 116), the type series consists of one male and two females.

Type locality. — Arizona, as given by Walsingham.

Notes about identity. — Due to unavailability of the type material for study, recognition of this species is presently not possible. Walsingham's original description refers only to color characters and thus is of very limited value. The relatively small size (wing expanse10 mm) and 'strong' (the word used by Walsingham; = broad?) longitudinal white line on the forewing, described by Walsingham, and southwestern distribution suggest that *S. albilineata* possibly belongs to the *S. ochristriata* complex. This group however includes many species, mostly undescribed, which are best distinguished by characters of the male genitalia. There are also other undescribed species with a similar color pattern which are not related to *S. ochristriata*. Confirmation of the identity and full description of *S. albilineata* must await study of the type material.

Phylogenetic relationships. — Walshingham (*loc. cit.*) indicated that *S. albilineata* was closely related to the European *S. schleichiella* (Zeller), probably on the basis of similarity in color pattern of forewings, but this hypothesis seems improbable. I have examined several undescribed Nearctic and Neotropical species with a similar forewing pattern of white longitudinal line over a darker, brownish background, and none is related to *S. schleichiella* in characters of genitalia. In fact species belonging to various genera exhibit this color pattern, which must have arisen several times convergently in the family. Moreover the group to which *S. schleichiella* belongs does not have any known representative species in the Nearctic region and also includes species which are closely related in male genitalia but do not have a white line on the forewing.

The only other described species with dark forewings overlaid with a white line in the fold is *S. charon*: it is distinctly smaller than *S. albilineata* (wing expanse about 7.5 mm vs 10 mm), dark olive-brown, has the forewing white streak narrow and occurs in southeastern United States. It is unlikely that the two names apply to the same species.

Geographical distribution and period of flight. — No data other than Walsingham's mention of Arizona as type area (Walsingham's "habitat") is known.

Hostplant. — Unknown. Braun (1940) reported that adults of *S. albilineata* were reared from larvae found in Arizona feeding on leaves of *Ambrosia psilostachya* DC. (Compositae) which they had webbed together. However identification of the specimens is unconfirmed.

3.3.32.2 *Scythris brevistrigella* (Chambers)

Butalis buristriga Chambers, 1875: 10 and 53. **Incorrect original spelling** [see notes about synonymy below].— Chambers, 1878c: 133 [note about misprinting].

Butalis brevistrigella Chambers, 1875: 53 [justified emendation for *B. buristriga*, a misprinting] and 54 [note about variation].— Smith, 1891: 107 [checklist, as a synonym of *B. impositella* Zeller]. ***Nomen dubium*.**

Butalis brevistriga Chambers, 1878c: 133 [incorrect subsequent spelling or unjustified emendation of *B. brevistrigella*].— Walsingham, 1888: 114 [notes about synonymy and variation].— Smith, 1891: 107 [checklist, as a synonym of *B. impositella* Zeller].

Scythris buristriga ; Dyar, 1902: 538 [catalogue].— Barnes and McDunnough, 1917: 190 [checklist].— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist] [all citations under this entry listed *buristriga* as a synonym of *S. impositella*].

Scythris brevistrigella ; Dyar, 1902: 538 [catalogue].— Hodges *et al.*, 1983: 19 [checklist] [these two citations listed *brevistrigella* as a synonym of *S. impositella*].

Scythris brevistriga ; Dyar, 1902: 538 [catalogue].— Barnes and McDunnough, 1917: 190 [checklist].— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist] [all citations under this entry listed *brevistriga* as a synonym of *S. impositella*].

Notes about synonymy and identity. — In his 1875 paper, Chambers indicated (p. 53) that the name *B. buristriga* associated with the description on p. 10 was misspelled (misprinted) and should be emended to *B. brevistrigella.* In a subsequent paper (1878c: 133), he made a further indication that *B. buristriga* was a misprinting , but the correct emendation *B. brevistrigella* was again misspelled (or unjustifiably emended to) *B. brevistriga* !

Walshingham (1888: 114), following Chambers' (1878a: 93) suggestion, mentioned that *B. brevistriga* [=*brevistrigella*] might be a synonym of *B. (= Scythris) impositella* Zeller, but he apparently did not make the synonymy formal in his usual way by listing the name preceded by a "=" sign below the senior name. The synonymy was formally indicated by Smith (1891: 107) who probably merely followed Walsingham's indication without actually checking the type material. However the very brief description given by Chambers, which mentions the species as being "dark purple brown, with a narrow streak along the middle of the [wing] fold, which is sometimes interrupted" indicates a color pattern which is doubtfully that of *S. impositella*. Furthermore, *S. impositella* is not known to occur in Texas (see under that species). Thus it is reasonable to suppose that the discrepancies in color pattern and geographic distribution indicate that *B. brevistrigella* is specifically distinct from *S. impositella* , hence that the two names are not synonyms. Chambers' suggested synonymies [in which he also incorrectly combined *S. trivinctella* (Zeller) with *S. impositella* — on which Walsingham disagreed] stemmed from the fact that he "bred great numbers of [supposed] *B. matutella* Clem. [later synonymized with *S. impositella* (Zeller) by Smith]. It varies greatly from specimens indistinguishable from *B. immaculatella* Cham. to forms which I have described as *B. dorsipallidella* and *B. brevistriga* [=*B. brevistrigella*], and some specimens approach very nearly *B. trivinctella* Zell. I am much inclined to consider them all as varieties of one species" (Chambers, 1878: 93). However Chambers gave no indication of hostplant, nor of whether the reared specimens all came from one or several lots of larvae. Another line of evidence to further doubt the synonymy is that *S. immaculatella* (Chambers) was also listed by Chambers and Walsingham as a probable synonym of *S. impositella* for the same reasons as for *S. brevistrigella* , but examination of the genitalia of the type shows that it is specifically and generically distinct. These considerations prompt me to remove *S. brevistrigella* from synonymy, but it is impossible to verify its identity without seeing the type. It is not even possible to say whether the species is a true scythridid. It is best regarded as a *nomen dubium*.

Type material. — Type material not located (not in MCZ nor in USNM) and possibly lost.

Type locality. — Bosque Co., Texas.

3.3.32.3 *Scythris dorsipallidella* (Chambers)

Butalis dorsipallidella Chambers, 1875: 10.— Chambers, 1878c: 133 [referenced list].— Walsingham, 1888: 114 [note about synonymy].— Smith, 1891: 107 [checklist, as a synonym of *B. impositella* Zeller]. ***Nomen dubium*.**

Butalis dorsipalidella ; Chambers, 1875: 54 [misspelled reference to *dorsipallidella*]

Scythris dorsipallidella ; Dyar, 1902: 538 [catalogue].— Barnes and McDunnough, 1917: 190 [checklist].— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist] [this name is listed as a synonym of *S. impositella* (Zeller) in all citations].

Notes about synonymy. — Comments made under *S. brevistrigella* about Walsingham's suggested synonymy with *S. impositella* also apply here. Chambers described *S. dorsipallidella* as "dark purple brown [with] the base of the primaries and the dorsal margin to the fold, pale ochreous yellow faintly suffused with purplish". Again, this color pattern does not occur in the known range of variation of *S. impositella* and this, combined with distributional aspects of the latter species prompts me to remove *S. dorsipallidella* from synonymy and treat it as *nomen dubium*.

Type material. — Type material not located (not in MCZ nor in USNM) and possibly lost.

Type locality. — Bosque Co., Texas.

3.3.32.4 *Scythris pilosella* (Zeller)

Butalis pilosella Zeller, 1873: 93.— Chambers, 1878: 134 [referenced list].— Walsingham, 1888: 114 [comparison with *suffusa*].— Smith, 1891: 107 [checklist]. ***Nomen dubium*.**

Scythris pilosella ; Dyar, 1902: 538 [catalogue].— Smith, 1903: 117 [checklist].— Barnes and McDunnough, 1917: 190 [checklist].— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist].

Notes about identity. — It is not possible to determine the identity of this species from Zeller's description alone. The description indicates a species with much yellow and yellowish mostly on the upper surface and suggests that upper surface of the forewings is without distinct pattern. The description is insufficient to even restrict significantly the number of possible species in collections to which this name may apply.

An old male specimen in USNM is labelled as follow: "[male symbol]" [handwritten]; "121" [handwritten]; "Butalis/ pilosella/ Z." [white, handwritten]. This specimen does not agree with Zeller's original description of *S. pilosella* which mentions dense pale yellow scales in the basal portion of forewing. The present specimen has forewings uniformly dark, metallic brass-colored. It belongs to the west European *S. fallacella* (Schläger). Without locality label, it is uncertain whether this specimen was collected in North America. I have seen no specimens of *S. fallacella* collected on this continent.

Type material. — Type material in BMNH and not examined. According to Zeller, it consists of a single male.

Type locality. — Massachusetts, as indicated by Zeller.

Geographical distribution and period of flight. — Known only from the type locality and holotype. No collecting date given by Zeller.

Hostplant. — Unknown.

3.3.33 Species excluded from the Scythrididae

3.3.33.1 *Scythris albapenella* (Chambers)

Butalis albapenella Chambers, 1875: 11.

Butalis albapennella [sic]; Chambers, 1878c: 133 [referenced list].— Smith, 1891: 107 [checklist] [both citations are misspelled references to *Butalis albapenella* Chambers].

Butalis albipennella [sic]; Walsingham, 1888: 113 [misspelled reference to *Butalis albapenella* Chambers]

Scythris albapennella [sic]; Dyar, 1902: 537 [catalogue].— Smith, 1903: 117 [checklist].— Barnes and McDunnough, 1917:189 [checklist].— McDunnough, 1939: 91[checklist].— Braun, 1948: 43 [note about identity] [all citations are misspelled references to *Scythris albapenella* (Chambers)].

Scythris albapenella ; Hodges *et al.*, 1983: 19 [checklist].

Note about placement. — The transverse rows of spines on the abdominal terga of the holotype readily indicate that this species belongs to the family BLASTOBASIDAE and the name *Butalis albapenella* Chambers is hereby transferred to that family. It represents an undescribed genus (D. Adamski, pers. comm. 1985). Braun (1948: 43) examined the type and, possibly as a result of haste, wrongly confirmed that it was a scythridid.

Type material. — HOLOTYPE male in MCZ, labelled: "Type/ 1516" [top of label white, rest red]; "Tex." [printed]; "Chambers." [printed]; "45" [very small handwritten label]; albapenella/ Chb." [handwritten]; "[male symbol] genitalia/ on slide no./ JFL-85-0290/ by J.F. Landry/ MCZ coll." [green, printed, with number and male symbol handwritten; this label was added by me]; "BLASTOBASIDAE/ Det. J.-F. Landry 1985" [this label was added by me]. Abdomen and genitalia dissected and mounted on slide no. JFL-85-0290.

Type locality. — Bosque Co., Texas.

3.3.33.2 *Scythris arizoniella* (Kearfott)

Holcocera arizoniella Kearfott, 1907: 8.

Colinita arizoniella ; Busck, 1907: 140.

Holcocera arizonella [sic]; Busck, 1909: 97 [mispelling of *H. arizoniella*, cited as a synonym of *S. eburnea* (Wlsm.)].

Colinita arizonella Busck [sic]; Busck, 1909: 97 [mispelling of *C. arizoniella*, cited as a synonym of *S. eburnea* (Wlsm.); the author of *C. arizoniella* is miscited as "Busck"].

Scythris arizoniella ; Barnes and McDunnough, 1917: 189 [checklist].— McDunnough, 1939: 91 [checklist].— Hodges *et al.*, 1983: 19 [checklist] [as a synonym of *S. eburnea* (Wlsm.)].

Note about placement. — The lectotype (see below) belongs to the family Coleophoridae and the name is hereby transferred to that family as *Coleophora arizoniella* (Kearfott), **new combination**.

Type material. — Type material partly in ZMUC and partly in USNM. It consists of two series, one of three specimens from San Bernardino Ranch, Cochise Co., Arizona, and one of 15 specimens from Phoenix, Arizona. The San Bernardino specimens bear red labels affixed by Kearfott and marked "TYPE" whereas the Phoenix specimens do not.

The series from San Bernardino Ranch is mixed: one female, complete and in good condition, is a *Coleophora* (Coleophoridae); the other two males, both without abdomen, are Scythrididae. Because it is not possible to determine with any certainty the specific and generic identity of the two male scythridids (see below), I have selected the female *Coleophora* as lectotype, thereby transferring the name *Holcocera arizoniella* Kearfott to the family Coleophoridae.

LECTOTYPE female, here designated, in SMEK, labelled: "San Bernardino Ranch/ Cochise Co. Ariz. 3750 ft./ Aug. F.H. Snow" [white, printed]; "TYPE/ Collection of/ W.D. Kearfott" [red, printed]; "Holcocera/ arizoniella/ Cotype Kearfott" [white, handwritten]; "450" [small white square, handwritten]; "Holcocera/ arizoniella/ Kearfott n. sp." [white with double red margin, handwritten]; "LECTOTYPE" [red, printed, added by me]; "LECTOTYPE/ Holcocera/ arizoniella/ Kearfott/ Selected by J.F. Landry, 1984" [white with red border, handwritten]; "Coleophora/ Det. J.-F. Landry 1984" [white, partly printed, partly handwritten]; "SMEK" [white with a green and a yellow stripe, typed, added by me].

PARALECTOTYPES, two males, here designated, labelled same as lectotype (one in SMEK, one in USNM). Right wings of the SMEK specimen are mounted on slide JFL-84-0250; the following additional label is attached to the specimen: "[male symbol] wings on/ slide no./ JFL-84-250/ by J.F. Landry/ SMEK coll." [green, partly printed, partly handwritten].

In the original description, Kearfott (1907, p. 8) clearly indicated that in addition to the San Bernardino specimens, he also regarded as conspecific 12 specimens "from Phoenix and Globe". The label data of the 15 Phoenix specimens agree with those given in the original description and the specimens all agree with the relatively brief description given by Kearfott. However I have seen none from Globe. Without type labels, it is not possible to be absolutely certain that some of these 15 specimens are actually those referred to by Kearfott, but this seems to be a reasonable supposition because of the agreement of label data with those given in the description. Assuming that the series includes part of the type material of *H. arizoniella* , it is not possible to determine which among the 15 specimens were the 12 included by Kearfott in the original description, because he did not specify how many were from each locality. There is no indication either to determine whether there is an error in the number mentioned and whether the reference to specimens from Globe could be a slip of the pen. Therefore in view of the uncertainty about inclusion of specimens in the type series, I have labelled all 15 Phoenix specimens "POTENTIAL/ PARALECTOTYPES/ Holcocera/ arizoniella Kft./ selected/ by J.F. Landry, 1984" [white label with red border] (all in USNM). Furthermore, because there is uncertainty about whether they are conspecific with the paralectotypes from San Bernardino Ranch (see below), I have excluded the series from consideration when selecting a lectotype.

Notes about identity of paralectotypes. — Identity of the two paralectotypes from San Bernardino Ranch cannot be determined with any certainty because genitalia cannot be studied. In color and size they resemble specimens of *Arotrura eburnea* Walsingham and of at least three other undescribed species occurring in the same geographic region. This superficial resemblance led Busck (1909) to synonymize *H. arizoniella* Kearfott [which he had previously transferred to *Colinita* Busck in an earlier paper (Busck 1907)] with *A. eburnea* . Close examination of non-genitalic characters suggests however that the paralectotypes are not conspecific with *A. eburnea* nor with one of the three undescribed species [which belongs to a distinct, new genus (see section 4.13)], but that they can belong to either of the other two undescribed species. These two undescribed species are members of another distinct, new genus that includes *S. divaricata* Braun and *S. oxyplecta* Meyrick (see section 4.12). Of the two San Bernardino paralectotypes, one is without vein CuA1 in the forewing , the other has CuA1 distinctly developed, forked with M3; both have the upper surface of the forewings with a small cluster of light rufous or buff scales medially and some very scattered light rufous scales over the surface; they could be conspecific but this cannot be confirmed with certainty. Coloration of the dorsal surface of forewings is similar in some specimens of the two undescribed species of the *S. divaricata* group but the latter have CuA1 separate or stalked and very obsolete. In *A. eburnea* and one of the undescribed species, veins M3 and CuA1 are distinct and very shortly stalked, and the dorsal surface of the forewings is uniformly ivory white with no trace of rufous suffusion.

The potential paralectotypes from Phoenix all appear to be conspecific with one another based on genitalia characters and belong to one of the above mentioned undescribed species of the *S. divaricata* group. They vary in color pattern of forewings from uniform ivory white or snow white to dirty white with small, distinct brown spots. In wing venation, some specimens have M3 and CuA1 of the forewing connate (or CuA1 absent) but M2 and M3 of the hindwing forked (they are long-stalked in the San Bernardino paralectotypes). All are distinctly smaller than the San Bernardino paralectotypes and may not be conspecific with the latter.

3.3.33.3 *Elachista texanella* Chambers

Elachista texanella Chambers, 1878c: 96.— Smith, 1891: 108.— Dyar, 1902: 536.— Smith, 1903: 117.— Barnes and McDunnough, 1917: 185.— McDunnough, 1939: 92.— Braun, 1948: 25.

Notes about identity.— This nominal species was not formerly included in the family Scythrididae. Braun (1948: 25) stated that two of Chambers' three syntypes were scythridids, but my examination of the type series shows that this is incorrect. The type series consists of three specimens, but no lectotype has been designated yet. Only one syntype is a scythridid which is too damaged to be recognized beyond family level (the specimen is without most appendages, right wings and abdomen). The other two syntypes are members of the family Cosmopterigidae. One is probably a species of *Anoncia*, as suggested by examination of its genitalia, the other belongs to a different, undetermined genus. A lectotype will be selected by R.W. Hodges from one of the two cosmopterigids, as part of a work in preparation about Chambers' types.

This species was omitted from Hodges *et al.*'s (1983) checklist. It is discussed here to avoid confusion that could arise from Braun's (1948) statements.

3.4 Summary of classification of described Nearctic species

The phylogenetic analysis of relationships among species, upon which the following classification is based, is included in the analysis of relationships of genera and major species lineages, presented in Chapter 5.

1. *Scythris ochristriata* (Walsingham, 1888)
2. *Scythris perspicillella* (Walsingham, 1888)
3. *Scythris suffusa* (Walsingham, 1888)
4. *Scythris altisierrae* Keifer, 1937
5. *Scythris limbella* (Fabricius, 1775)
    - *Tinea variella* D. & S., 1775
    - *Tinea quadriguttella* Thunberg, 1794
    - *Tinea tristella* Hübner, 1796
    - *Tinea chenopodiella* Hübner, [1813]
6. *Scythris immaculatella* (Chambers, 1875), status re-established
    - *Scythris pacifica* McDunnough, 1927, new synonymy
7. *Scythris mixaula* Meyrick, 1916
8. *Scythris trivinctella* (Zeller, 1873)
9. *Scythris ypsilon* Braun, 1920
10. *Scythris anthracina* Braun, 1923
11. *Scythris basilaris* (Zeller, 1855)
    - *Butalis flavifrontella* Clemens, 1860
12. *Scythris eboracensis* (Zeller, 1855)
    - *Butalis fuscicomella* Clemens, 1860, new synonymy
13. *Scythris interrupta* Braun, 1920

14. *Scythris inspersella* (Hübner, [1817])

    Gelechia aterrimella (Walker, 1864), new synonymy

    Scythris hypotricha de Joannis, 1920

    Scythris epilobiella McDunnough, 1942, new synonymy

15. *Scythris noricella* (Zeller, 1843)

    Scythris magnatella Busck, 1904, new synonymy

    Scythris noricella latifoliella Wolff, 1964, tentative new synonymy [type not examined]

16. *Scythris piratica* Meyrick, 1928

17. *Scythris inornatella* (Chambers, 1879), new combination (from *Coleophora*)

18. *Scythris charon* Meyrick, 1918

19. *Areniscythris brachypteris* Powell, 1976

20. *Scythris graminivorella* Braun, 1920

21. *Scythris matutella* (Clemens, 1860), status re-established

    Sinoe ambroseaiella Chambers, 1873, *nomen nudum*

    Scythris winnella Busck [Brower 1984], *nomen nudum*

22. *Scythris impositella* (Zeller, 1855)

    Gelechia monstratella Walker, 1864, synonymy unconfirmed [type not examined]

23. *Scythris scintillifera* Braun, 1927

24. *Scythris reducta* Braun, 1923

25. *Scythris fissirostris* Meyrick, 1928

26. *Scythris confinis* Braun, 1920

27. *Scythris planipenella* (Chambers, 1875), status re-established

    Butalis plausipenella Chambers, 1875, misspelling

    Butalis planipennella Chambers, 1878c, misspelling

    Butalis plausipennella Chambers, 1878c, misspelling

Coleophora albacostella Chambers, 1875, new synonymy

Coleophora fuscostrigella Chambers, 1878a, new synonymy

Scythris hemidictyas Meyrick, 1928, new synonymy

28. *Colinita sponsella* Busck, 1907, generic status re-established

29. *Arotrura eburnea* Walsingham, 1888, generic status re-established

30. *Scythris divaricata* Braun, 1923 [new addition to North American fauna north of Mexico]

31. *Scythris oxyplecta* Meyrick, 1916

Unclassified species

32. *Scythris albilineata* (Walsingham, 1888), *nomen dubium* [type not examined]

33. *Scythris brevistrigella* (Chamber, 1875), *nomen dubium* [type lost]

Butalis buristriga Chambers, 1875, misspelling

Butalis brevistriga Chambers, 1878c, misspelling

34. *Scythris dorsipallidella* (Chambers, 1875), *nomen dubium* [type lost]

35. *Scythris pilosella* (Zeller, 1873), *nomen dubium* [type not examined]

Species excluded from the Scythrididae

Scythris albapenella (Chambers, 1875): transferred to the Blastobasidae where it represents an undescribed genus. Original combination: *Butalis albapenella* .

Scythris arizoniella (Kearfott, 1907): transferred to the Coleophoridae in the genus *Coleophora* . Original combination: *Holcocera arizoniella* .

Astyages cylindrella (Fabricius, 1777): a junior synonym of *Stathmapoda pedella* (L.) (family Oecophoridae), erroneously listed as a synonym of *S. limbella* (F.) by some authors. Original combination: *Tinea cylindrella* .

4. REVISION OF SELECTED NEARCTIC GENERA OF SCYTHRIDIDAE

4.1 Introduction

Composition of the Scythrididae in terms of described genera is still incompletely resolved. Up to 30 genera have been included in the family by various authors and most of these names were applied to Old World taxa. Of these, 13 have been subsequently transferred to other families of Microlepidoptera, mostly Gelechioidea (Table 1), and two more are here removed (see below).

Table 2 shows the 16 genera, described prior to this work, that I recognize as belonging to the Scythrididae. In addition to examining type species of New World genera, I have examined those of seven of Old World genera and illustrations of the genitalia of some others, and have also relied on unpublished notes and photographs [courtesy of Dr. P. Passerin d'Entrèves, University of Turin (Italy), who has worked on the Palearctic and Afrotropical scythridids for several years and has examined type specimens of several type species of Old World scythridid genera].

Unfortunately, the status of a few generic names remains problematic, and their inclusion in the Scythrididae tentative, because material is not easily, if at all, available to study. Most of the original descriptions of these genera are too generalized to be useful, lack illustrations of diagnostic parts, or include illustrations that are too nebulous to be useful. *Synacroloxis* Gozmany and *Syringopais* Hering, both hitherto included in the Scythrididae, are here excluded (Table 1). Although I have not examined specimens of *Synacroloxis*, the description and illustration of the wing venation and head profile of the type species (*S. dis* Gozmany, 1952) do not correspond to that of a scythridid: the labial palpi are extended high above the vertex, with the second article ventrally tufted and the third article as long as the second, R4 and R5 of the forewing are basally forked, and R1 of the forewing is about equidistant between the wing base and the base of R2. The genitalia are not described nor illustrated. Curiously, Gozmany (1952) noted a marked resemblance between *S. dis* and members of the dichomerine gelechiids, yet he did not indicate why he considered this genus to be scythridid. The haustellum is ambiguously described as "smooth"; if this is meant to indicate an unscaled proboscis, then the species is not a gelechioid. The genus is here removed from the Scythrididae but provisionally left in the Gelechioidea without family assignment.

Specimens of *S. temperatella* (Lederer), the type species of *Syringopais* Hering, have spatulate scales on the vertex (similar to those shown in Fig. 72), scattered spines on the abdomen, a wide ductus bursae, narrow ductus seminalis and a signum. None of these character states is found in scythridids and the genus is hence excluded from the family Scythrididae. The presence of scales on the base of the haustellum, upcurved labial palpi and maxillary palpi folded over the base of haustellum indicates inclusion in the Gelechioidea, but family placement is undetermined.

Inclusion of *Haploscythris* Viette in the Scythrididae remains questionable (Passerin d'Entrèves, pers. comm. 1984). The genus was described for a Madagascan species (*H. paulianella* Viette, 1956) known from a single male specimen apparently in too bad condition to confirm assignment to the scythridids (Passerin d'Entrèves, pers. comm. 1984); the original description and illustration of the genitalia are also inadequate in that respect. The identity of *Necrothalassia* Amsel and of *Paralogistis* Meyrick remains unknown. These three genera are provisionally left in the Scythrididae.

Only four generic names other than *Scythris* Hübner have been proposed for, or applied to, New World scythridids: *Arotrura* Walsingham, 1888, *Colinita* Busck, 1907, *Areniscythris* Powell, 1976, and *Apostibes* Walsingham, 1907. However, the Neotropical species placed in *Apostibes* (Walsingham 1914), a name originally proposed for a species from Algeria, do not belong there and the genus is not represented in the New World. The New World fauna includes few species with Old World generic affinities. Of the 14 genera treated in this work, 10 are newly described and 13 are restricted to the New World. On the other hand, among the 13 described Old World genera, only *Scythris* is represented in the New World. Further work may show that scythridids of the two regions regions share more affinities and related taxa than current knowledge suggests, but at present the two faunas appear to have few elements in common at the generic level.

The present generic revision is selective because many other undescribed genera, at least 20 to 30, are represented among Nearctic Scythrididae, especially in the small, generally dark-colored, diurnal groups characteristics of mesic and montane habitats, and those will be the object of future revisions. Newly described genera were selected according to diversity of included species, abundance of material available for study, the possibility of being hypothesized as monophyletic, and lack of close relationship or representation in the Old World. Further studies may also show that some of the genera defined herein are too broad and may need to be redefined more restrictively.

4.2 Description of family Scythrididae

In the following description, I attempt to present as comprehensive an account as possible of the adult characteristics of Nearctic members of the family Scythrididae. I have based this description on examination of nearly 300 Nearctic and Neotropical species and about 75 Old World species (Table 3). Skeletal features of head and thorax were examined in about 50 Nearctic species representing a wide range of generic entities, both described and undescribed. Undoubtedly, with so many undescribed and undiscovered taxa, species will be found that do not agree with some of the features here described. Except for features of the genitalia however, structures of Scythrididae appear to be remarkably uniform.

Table 1. Genera excluded from the Scythrididae

Genus	original placement	inclusion in Scythrididae	present placement
Amphisbatis Zeller, 1870	Elachistidae	Spuler, 1910	Oecophoridae (Fletcher 1929)
Arragonia Amsel, 1942b	Scythrididae	original	Holcopogonidae (Gozmany 1967)
Bagdadia Amsel, 1949	Scythrididae	original	Gelechiidae (Sattler 1973)
Bubulcellodes Amsel, 1942b	Scythrididae	original	Holcopogonidae (Gozmany 1967)
Chionella Amsel, 1935b	Scythrididae	original	Symmocidae (Sattler 1973)
Epidola Staudinger, 1859	Gelechiidae (Wocke 1861)	Amsel, 1942a	Gelechiidae (Sattler 1973)
Heringita Agenjo, 1953	Scythrididae	original	Holcopogonidae (Passerin d'Entrèves, pers. comm. 1984)
Holcopogon Staudinger, 1879	Tineidae (Kirby 1881)	Amsel, 1942b	Holcopogonidae (Gozmany 1967)
Oecia Walsingham, 1897	Scythrididae	original	Lecithoceridae (Le Marchand 1947)
Orinympha Meyrick, 1927	Yponomeutidae	Clarke, 1955	Yponomeutidae (Hodges et al. 1983)
Paltodora Meyrick, 1894	Gelechiidae	Agenjo, 1966	Gelechiidae (Kloet & Hinks 1972)
Synacroloxis Gozmany, 1952	Scythrididae	original	Gelechioidea *incertae sedis* (this work)
Syringopais Hering, 1918	Scythrididae	original	Gelechioidea *incertae sedis* (this work)
Tenieta Amsel, 1942a	Scythrididae	original	Symmocidae (Gozmany 1957)
Turatia Amsel, 1942b	Scythrididae	original	Holcopogonidae (Gozmany 1967)

Table 2. Genera included in the Scythrididae

Genus	Distribution	Type species
Areniscythris Powell, 1976	Nearctic	**A. brachypteris* Powell, 1976
Arotrura Walsingham, 1888	Nearctic	**A. eburnea* Walsingham, 1888
Apostibes Walsingham, 1907a	Palearctic (Algeria)	†*A. griseolineata* Walsingham, 1907a
Catascythris Amsel, 1935a	Palearctic (Middle East)	†*C. kiberella* Amsel, 1935a
Colinita Busck, 1907	Nearctic	**C. sponsella* Busck, 1907
Enolmis Duponchel, 1845	Palearctic (Mediterranean)	**Lita acanthella* Godart, 1824
Episcythris Amsel, 1939	Palearctic (Sardinia)	†*E. albonigrella* Amsel, 1939
Eretmocera Zeller, 1852	Afrotropical, Palearctic (predominantly tropical Africa)	**E. fuscipennis* Zeller, 1852
Erigethes Walsingham, 1907	Palearctic (Algeria)	**E. strobilacei* Walsingham, 1907
Haploscythris Viette, 1956	Afrotropical (Madagascar)	†*H. paulianella* Viette, 1956 [familial identity unconfirmed]
Mapsidius Walsingham, 1907	Hawaii	**M. auspictata* Walsingham, 1907
Necrothalassia Amsel, 1935a	Palearctic (Middle East)	*N. argilosella* Amsel, 1935a [familial identity unconfirmed]
Paralogistis Meyrick, 1913	Afrotropical (South Africa)	*P. ochrura* Meyrick, 1913 [familial identity unconfirmed]
Parascythris Hannemann, 1960	Palearctic (European)	**Butalis muelleri* Mann, 1871
Rubioia Agenjo, 1962	Palearctic (Spain)	†*R. rubioi* Agenjo, 1962
Scythris Hübner, 1825	Holarctic (predominantly European)	**Tinea chenopodiella* Hübner, 1813

An asterisk (*) preceding the name of a type species indicates that specimens were examined, whereas a dagger (†) indicates that only photographs or illustrations of the genitalia were seen.

Table 3. Non-Nearctic species of Scythrididae examined for study of genera and definition of the family

Species	**Distribution**
Scythris aerariella (Herrich-Schäffer)	Europe
Scythris alseriella Turati	Europe
Scythris amphonycella (Geyer)	Europe
Scythris apicalis (Zeller)	Europe
Scythris bifissella (Hofmann)	Europe
Scythris braschiella (Zeller)	Europe
Scythris cicadella (Zeller)	Europe
Scythris clavella (Zeller)	Europe
Scythris confluens (Staudinger)	Europe
Scythris cuspidella (Denis & Schiffermüller)	Europe
Scythris cupreella (Staudinger)	Europe
Scythris disparella (Tengström)	Europe
Scythris dissimilella (Herrich-Schäffer)	Europe
Scythris dividua Meyrick	Peru
Scythris dorycniella (Millière)	Europe
Scythris empetrella Karsholt & Nielsen	Europe
Scythris epistrota Meyrick	New Zealand
Scythris ericetella (Heinemann)	Europe
Scythris ericevorella (Ragonot)	Europe
Scythris eucharis Walsingham	Algeria
Scythris fallacella (Schläger)	Europe
Scythris flabella (Mann)	Europe
Scythris flavilaterella Fuchs	Europe
Scythris flaviventrella (Herrich-Schäffer)	Europe
Scythris fonticola Meyrick	South Africa
Scythris fuscoaenea (Haworth)	Europe
Scythris fuscocuprea (Haworth)	Europe
Scythris fallicella de Joannis	Europe
Scythris glacialis (Frey)	Europe
Scythris grandipennis (Haworth)	Europe
Scythris gravatella (Zeller)	Europe
Scythris gurdella (Christoph)	Europe
Scythris hornigii (Zeller)	Europe
Scythris humillimella (Staudinger)	Europe
Scythris immunis Meyrick	Peru
Scythris inspersella (Hübner)	Holarctic
Scythris knochella (Fabricius)	Europe
Scythris laminella (Denis & Schiffermüller)	Europe
Scythris limbella (Fabricius)	Europe and eastern North America
Scythris medullata Meyrick	Colombia
Scythris noricella (Zeller)	Holarctic
Scythris notorrhoa Meyrick	Brazil (Amazonas)
Scythris obscurella (Scopoli)	Europe
Scythris palustris (Zeller)	Europe
Scythris paullella (Herrich-Schäffer)	Europe
Scythris pascuella (Zeller)	Europe
Scythris potentillella (Zeller)	Europe

Table 3 (cont.). Non-Nearctic species of Scythrididae examined for study of genera and definition of the family

Species	Distribution
Scythris picaepennis (Haworth)	Europe
Scythris productella (Zeller)	Europe
Scythris punctivittella (Costa)	Europe
Scythris restigerella (Zeller)	Europe
Scythris salviella Jäckh	Europe
Scythris scipionella (Staudinger)	Europe
Scythris scopolella (Linné)	Europe
Scythris seliniella (Zeller)	Europe
Scythris siccella (Zeller)	Europe
Scythris sinensis (Felder & Rogenhofer)	eastern Palearctic
Scythris speyeri (Heinemann)	Europe
Scythris subseliniella (Heinemann)	Europe
Scythris tabidella (Herrich-Schäffer)	Europe
Scythris tibicina Meyrick	Peru
Scythris tributella (Zeller)	Europe
Parascythris muelleri (Mann)	Europe
Enolmis acanthella (Godart)	Europe
Enolmis delicatella (Rebel)	Europe
Enolmis desidella (Lederer)	Middle East
Erigethes strobilacei Walsingham	Algeria
Eretmocera fuscipennis Zeller	Afrotropical
Eretmocera medinella (Staudinger)	central Palearctic
Mapsidius charpentierii Swezey	Hawaii
Mapsidius auspictata Walsingham	Hawaii

45 undescribed species from the Neotropical region
11 undetermined or undescribed species from South Africa
1 undetermined or undescribed species from Madagascar
5 undetermined or undescribed species from Afghanistan
4 undetermined or undescribed species from Australia

Diagnostic characters of the Scythrididae and separation of scythridids from similar-looking Gelechioidea are indicated in section 3.1.

Description. — Head with scales narrowly lanceolate and more than 10 times lonnger than wide (Figs. 65, 69, 70) or suboval and 2-5 times longer than wide (Fig. 66), closely appressed ("smooth scaled"), oriented longitudinally with apices pointed anteriorly and ventrally (Figs. 65-69); neck tufts narrow, compact, transverse. Ocelli prominent, or flat and somewhat indistinct (Figs. 95-96, 98-100, 103, a,b), or absent (Figs. 97, 101-102, 104-109, a, b). Chaetosemata absent. Antenna slender, filiform or subfiliform, extended to two-thirds or three-quarters of forewing; scape only slightly wider than base of flagellum, with antero-ventral pecten in most species, without pecten in few species; flagellum ventrally densely ciliate in most species, indistinctly and scatteringly so in some species, with 23-64 articles. Maxillary palpi with 1, 2 (Fig. 103 d), 3 (Fig. 99 d) or 4 (Figs. 95-98, d) articles, folded over base of haustellum (Fig. 69) or inconspicuous. Haustellum well developed and, in most species, long or very long, extended to middle or apex of abdomen, in few species reduced, barely extended to prothorax and indistinct when coiled; base covered with scales (Figs. 65, 66, 69). Labial palpi upcurved (Figs. 67-69), or in some species with short palpi porrect or very slightly upcurved; palpi with scales appressed, not tufted, article 3 shorter than article 2 and subequal or very slightly longer than article 1 (Figs. 95-109, c); palpi, when upcurved, extended to base of antenna or to level of vertex (Fig. 67), in very few species extended slightly beyond level of vertex, or to middle of frons (Fig. 68); equal or moderately longer than height of face (LP/HH = 1.0-2.6); labial palpi in frontal view with articles 2 slightly divergent, articles 3 parallel (Fig. 69).

Prothorax (Figs. 110-112). Pronotum (Fig. 110) broad, transversely arched, medially with longitudinal carina, antero-ventral margin with median protuberance; antero-lateral margin fused with dorsal margin of propleuron, noto-pleural suture distinct; postero-median sclerite developed, posteriormost portion transverse. Pre-episternum (Fig. 110) with prominent but narrow lateral lobes. Propleuron (Figs. 110-111) with well developed pleural "wart", inner margin antero-dorsally bent inwardly, antero-dorsal angle prolonged into posteriorly-directed apodeme or flange. Sternum (Fig. 110) concave, relatively narrow, subquadrate or subtriangular and ventrally narrowed, with complete or incomplete, or without, median longitudinal carina; precoxal bridge sclerotized, joined to anterior margin of propleuron with distinct sterno-pleural suture; ventral apex of sternum lightly sclerotized or membranous, attachement to furcal process thin. Katepisternum (Fig. 110) small, narrowly subtriangular, loosely articulated to antero-ventral angle of propleuron. Furcal process (Figs. 111-112) with or without dorsal, crested intercoxal lamella; sterno-pleural bridge laterally broadly fused to posterior margin of pleuron, pleural suture distinct; furcal apophysis short; posterior margin of furca evenly rounded, sinuate, or produced just beneath apophysis. Patagium (Fig. 110) transverse, crescentic, almost as broad as pronotum. Parapatagium (Fig. 110) moderately sclerotized, very narrow, less than half width of patagium, crescentic, with or without small, dorsal, peg-like protuberance.

Mesothorax. Scutum convex, with indistinct and abbreviated trace of median longitudinal sulcus. Scutellum subtriangular, shield-shaped. Spina without dorsal crest. Epimeron smaller than anepisternum, anterior margin prolonged along postero-dorsal margin of anepisternum, anteriormost portion of prolongation slightly curled around anepisternal margin, very shallow groove thus formed; medial area longitudinally bissected by complete or interrupted trans-epimeral sulcus formed by branch of pleural suture. Precoxal suture (Figs. 113-128) extended from antero-lateral angle of basisternum obliquely across pre-episternum, in most species incomplete (Figs. 114-128), medially interrupted and in many without upper sector joining pleural suture, in few species complete (Fig. 113) with upper sector joining pleural suture at apex of anapleural cleft. Margino-pleural suture in most species very short (Figs. 114-117, 121-125), in some extended to half width of katepisternum or almost to lower sector of precoxal suture (Figs. 119-120, 126). Pre-episternum in many species with irregularly shaped, transluscent area of unmelanized or semi-membranous cuticle (Figs. 117,125). Basisternum anteriorly margined. Dorsal apex of stem of furca with articulation ventrad of point of divergence of furcal arms and furcal process; lamellae of furcal stem dorsally proximate or subcontiguous; lateral arms of furca with apically bifurcate, secondary apophysis. Trochantin absent. Meron antero-dorsally bisected by incomplete, oblique suture demarcating lightly sclerotized, anterior area.

Metathorax. Metascutum narrow, oblique, anterior margin deeply V-emarginate, emargination almost extended to metascutellum and with distinct medial protuberance articulating to medio-caudal margin of mseoscutellum; antero-laterally with elongate zone of microtrichia; latero-posterior margin sharply delineated bymarked internal ridge; laterally with or without lateral impression. Metascutellum transverse, angulate, trapezoid or rectangular. Anepisternum very small, less than half size of anepisternum of mesothorax. Infra-episternum broad, suboval, sharply demarcated by two oblique, well-delineated sutures (precoxal and margino-pleural sutures, or new sutures?), sutures obliquely extended ventrally where joined together and attached to anterior stem of furca, anteriorly lined with thinly sclerotized, medio-ventrally deeply emarginate lamella extended from anapleural cleft to intercoxal lamella, in ventral aspect sternal region appearing V-shaped. Intercoxal lamella present (Fig. 132) or absent (Fig. 133). Metepimeron very reduced, as narrow longitudinal band with dorsal arm extended from dorsal margin to secondary arm of furca. Katepisternum (?) small, triangular. Coxal suture incomplete, with postero-dorsal sector interrupted and not extended to furco-coxal joint, posterior portion of meron thus fused with (not demarcated from) eucoxa (Figs. 134; compare with complete coxal suture in Fig. 135). Trochantin absent. "Subcoxal" sclerite separated from eucoxa by complete suture (Figs. 132-133). Metathoracic furca (Figs. 138-143): stem with joint or articulation immediately ventrad of medial junction (furcation) of secondary furcal arms (Figs. 136, 138-140); rods of furcal stem expanded caudally into narrow lamellae; lamina of secondary furcal arms developed, extended from about middle of furcal process to about two-thirds of secondary furcal arms; antero-medial process of furca apically with pair of ligaments, ventral margin with pre-apical or medial ligament extended ventrally (Figs. 138-140); furcal apophysis arising near apex of furcal process, with paired, secondary dorsal projections, in lateral aspect anterior projection short and projected dorsally or antero-dorsally, posterior projection long, rod-like, projected caudally, in most species not extended to secondary furcal arms (Figs. 138-140), in dorsal aspect posterior projections extended somewhat lateral of furcal process (Figs. 141-143).

Legs. Tibial spurs 0-2-4, inner spur of each pair longer than outer one. Foretibia with well developed epiphysis about 0.25x length of tibia. Tarsomeres 1-4 ventrally with two apical spines (Figs. 79-80), in some genera (*e.g. Areniscythris* , *Neoscythris*) spines very reduced, inconspicuous (Fig. 81); in some species tarsomeres 1-4 with one additionnal shorter, pre-apical spine (*S. laminella* , some specimens of *S. limbella*) (Figs. 80) or with several scattered spines on shaft (*S. seliniella*).

Wings lanceolate, apex pointed or acute; hindwing narrower than forewing and with hind margin straight, or about as wide as forewing and with hindmargin slightly or moderately sinuate; cilia of hindwing longer than wing width (Figs. 150-161). Pterostigma on forewing in some species (Figs. 159), absent in most. Forewing (Figs. 150, 157) with 12 veins; Sc extended to costa at or before middle; R1 attached to Rs at about middle of cell; distance between R1 and R2 at least twice distance from R2 to R3; R4 and R5 stalked, R4 extended to costa, R5 to termen; cell long; medial and most radial branches attached in distal fourth or fifth of wing; M3 and CuA1 connate, stalked, or forked; CuP short near hind margin; 1A+2A forked basally, 1A obsolete and indistinct in most species. Hindwing (Figs. 150, 157) with seven or eight veins; Rs and M1 subparallel in most species, forked in few species; cell open or closed; 1A+2A forked basally, obsolete and unmelanized but distinctly convex. Wings well developed and functional in most species, reduced, leathery and non-functional in one species of *Areniscythris* from California. Frenulum in males with one bristle (Figs. 156-157), in females with one, two (Figs. 151, 153-155) or three (Figs. 150, 152) bristles. Retinaculum of females of one subcostal unit and one subdorsal unit. Frenum present (Figs. 150-156, 159-161) or absent (Figs. 157-158).

Abdomen. T1 and T2 (Figs. 167-169) fused, transverse suture zone delineated by anterior margin of T2 or posterior margin of T1, or both (suture zone appearing doubly margined) lateral rims. T1 and T2 with lateral margins sclerotized, rim-like and fused to each other, appearing as one continuous lateral margin with a jog at level of suture zone. Surface of T1 mostly membranous except posterior third with triangular, lightly sclerotized area. T2-T7 membranous or variously sclerotized, in most species anteriorly finely margined. S2 (Figs. 170-172) with anterior, hollow apodemes and with (Figs. 170-171) or without (Figs. 172) venulae on sternal surface as prolongation of apodemes; in few species apodemes reduced, short, stubby, lobe-like; venulae, when present, somewhat ill-defined, as more or less markedly sclerotized bands differentiated from less sclerotized or membranous surrounding cuticle (Figs. 171); anterior third of sternum or area between venulae smooth, unscaled, in many species medially slightly raised or ridged; posterior third or half of sternum variously sclerotized, in most species of indistinct outline. S3-S7 (and S8 in males) variously sclerotized, in many species markedly more so than corresponding terga, unmargined. In males, T8 and S8 of normal construction and not differentiated from those of preceding segments, or either one or both moderately or strikingly developed, sclerotized and modified as variously shaped, hood-like or valva-like plate overlapping or enclosing genitalia (*e.g.* Figs. 174-175, 177-178, 191-193, 200-202, 205-206, 226, 255-256, 267, 271, 275-276, 280-281, 292-293, 298, 302). In females, segments 6 and 7 or normal construction, or variously developed and differentiated, more sclerotized than preceding segments, with posterior margin variously emarginate or projected or lobate, in many species with fovea or sclerotized structures reminding of glandular openings (*e.g.* Figs. 304, 306, 309, 312, 314, 320, 326, 328, 332, 334, 340, 342, 345, 347, 351, 359, 362-363, 365, 369-370).

Male genitalia symmetrical or variously asymmetrical, frequently very strikingly so (*e.g.* Figs. 233-248), in many species with parts fused, reduced, lost, or in displaced position and difficult to recognize (*e.g.* Figs. 213-214, 245-248, 257-262), in many species some structures very thickly sclerotized and darkly melanized, opaque. Tegumen hood-like or dome-like, elongate (*e.g.* Figs. 188, 193, 204, 289, 299-300) or transverse (*e.g.* Figs. 186, 214, 216, 264, 283), ± flat or markedly arched, vaulted or convex (*e.g.* Figs. 230-231, 234-235, 237, 240-241, 245-246, 259-260), anterior margin in many species variously V- or U-emarginate (*e.g.* Figs. 186, 188, 195, 219, 227, 231, 251, 273, 278, 283), in several species tegumen completely divided into two lateral halves by emargination (*e.g.* Figs. 221, 264, 269, 290, 300); in several species, lower margins markedly reflexed inwardly (Figs. 224, 237-238, 242, 246-247, 274, 287,), in some species tegumen ventrally almost completely closed by reflexed margins (Figs. 204, 211); in few species tegumen reduced to narrow sclerotized anterior band, rest of walls membranous (*Hyalinixys*) (Figs. 268-269); in many species (*Rhamphura*) latero-caudal margin of tegumen with heavy, beak-like, paired projections with ventral pegs and inner glanduliform sacs (Figs. 173, 176, 179, 180-181). In many species intersegmental membrane between tergum 8 and tegumen variously expanded and sclerotized, hood-like, covering partly or wholly the genitalia, variously fused to tergum 8 and to antero-dorsal portion of tegumen (*e.g.* Figs. 266-267, 272, 278-279, 282-283, 288, 294-295, 299-300). Uncus in many species present and variously developed (*e.g.* Figs. 185-188, 193-195, 203-204, 220-221, 249, 257), reduced (*e.g.* Figs. 211, 237, 243, 245-246) or absent in others. Socii shaped as two membranous and setose lobes in some species (*e.g.* Figs. 203-204, 211, 213-214, 218-219), in many species developed into variously shaped, sclerotized arms, arms in some species as long as genitalia (*e.g.* Figs. 264, 269, 272, 278, 283, 285, 289, 295, 299). Gnathos absent from few species, present in most species and variously developed, frequently asymmetrical and strikingly enlarged with very long distal projection (*e.g.* Figs. 240, 243, 248-249, 252, 257-258, 259-262); distal projection variously shaped, in several species longer than genitalia and bent cephalad (*e.g.* Figs. 249, 257, 259); in many species gnathos skewed leftward, with left proximal arm fused to posterior margin of left lateral wall of tegumen (*e.g.* Figs.235-237, 240-241, 246, 252, 261) . Vinculum well developed, U-shaped with saccal region directed ventro-anteriorly (*e.g.* Figs. 173, 176, 180), or linguiform with saccal region extended posteriorly under genitalia with its morphologically anterior margin pointed caudally (*e.g.* Figs. 186-187, 193-194, 199, 203), or markedly reduced to narrow, transverse or arched plate or band ± indistinguishably fused to base of valvae (*e.g.* Figs. 213, 220, 230, 233, 236, 265, 271, 274, 279, 284, 287, 291, 296). Valvae well developed, symmetrical or variously asymmetrical, strikingly so in some species (Figs. 234, 239, 244, 247-248, 261), simple or variously sculptured or ornate (Figs. 213, 283, 295), in several species inner wall, or cucullar lobe when present, densely setose (*e.g.* Figs. 173, 195, 219, 230, 273, 277, 282); in several species valvae indistinct, markedly reduced to small protrusions or setose lobes (*e.g.* Fig. 258); in most species valvae basally fused together and with vinculum, in some species valvae fused medially (*e.g.* Figs. 214, 219). Diaphragma membranous, or in several species with variously sclerotized plates and spines in fultura superior and/or fultura inferior (*e.g.* Figs. 294-296). Juxta and/or sclerotized anellus, or ventral part of anellus (= manica; in many species, structure called juxta of uncertain homology), articulated medially (*e.g.* Figs. 265, 270, 284, 287, 301) or laterally (*e.g.* Figs. 233, 239, 244) to base of vinculum-valvae and fused or articulated to base (*e.g.* Figs. 176, 179, 193, 213, 218, 259, 279, 282, 285, 289) or middle (*e.g.* Figs. 222, 265, 270, 274) of wall of aedeagus. Aedeagus variously developed, or reduced, of diminutive size in many species (*e.g.* Figs. 173, 203, 233, 257, 295); ventro-basally or ventro-medially ankylosed by juxta and/or by plates of diaphragma, apex in many species wedged between right valva and gnathos (*e.g.* Figs. 226-227, 231, 234, 236, 252, 259, 261); aedeagus variously shaped, simgle or ornamented with spines or projections, straight or variously twisted or sigmoid, very short and stubby or extremely long and extended to base of abdomen; in some species aedeagus reduced to membranous or semi-membranous fold in diaphragma; wall with or without windows (areas of light sclerotization); cornuti absent. Ductus ejaculatorius, in many species, enclosed in variously developed, expanded, semi-rigid, membranous sheath or chamber (= bulbus ejaculatorius), in several species bulbus ejaculatorius strikingly expanded into abdomen, coiled or ovoid, in some species larger than entire genitalia (*e.g.* Figs. 233, 239, 244, 247-248); vesica narrow, seemingly not eversible.

Female genitalia. Ostium bursae variously positioned on sternum 8 (*e.g.* Figs. 305, 307, 311, 313, 315-317, 331, 341, 352-353, 364, 371), or between sterna 7 and 8 (*e.g.* Figs. 318-319, 326, 330, 333, 335, 337, 339, 343, 347-348, 354-356, 366-367), or on sternum 7, in many species at apex of variously developed and shaped, frequently asymmetrical, sterigma, in many species sterigma projected out of ventral abdominal wall, in some species projection very long (*e.g.* Figs. 305, 311, 316-319, 321-322, 324, 333, 335, 341, 343, 345, 347, 353, 366). Ostium extremely small (*e.g.* Figs. 307-308, 315, 318, 321-322, 326, 330-331, 333, 339), or medium (*e.g.* Figs. 324-325, 345, 352, 360) or very wide (*e.g.* Figs. 353, 364). Ductus bursae, in most species, membranous, very fine and delicate (*e.g.* Figs. 372-380, 386-400), in few species, distal portion sclerotized (*e.g.* Figs. 321, 360, 364); in few species antrum developed and wide (*e.g.* Figs. 347-348, 364, 366). Inception of ductus bursae at posterior end of bursa (*e.g.* Figs. 386, 388-390), or medially on (*e.g.* Figs. 373, 375-376, 379-381, 387, 391-392, 396-398), or at anterior end of bursa (*e.g.* Figs. 372, 377-378, 385, 393-395, 399). Corpus bursae in most species single (*e.g.* Figs. 372-387, 393-400), in very few species double (*e.g.* Figs. 388-389), wall membrane very thin, delicate; signum absent; bursa variously shaped, ovoid (*e.g.* Figs. 383, 385, 391, 396), spherical (*e.g.* Figs. 374, 388-389), pear-shaped (*e.g.* Figs. 379-380), mushroom-like (*e.g.* Fig. 400), tube-like (*e.g.* Figs. 375, 377), bean-shaped (*e.g.* Fig. 382), U-shaped (*e.g.* Figs. 393, 395), etc.; ductus seminalis relatively broad, in most species extended as continuation of gradually or abruptly tapered posterior portion of bursa (*e.g.* Figs. 374-375, 377-378, 382-383, 386, 391-392, 393-400). Anterior and posterior apophyses relatively thin (*e.g.* Figs. 307, 315, 318, 324, 326, 331, 337, 339, 346), ovipositor of various lengths, in most species shorter than abdomen; papillae anales membranous or lightly sclerotized, in few species apex with sclerotized, blade-like ridges (*e.g.* Figs. 357-358).

4.3 Key to Nearctic genera treated in this work

1. Frenum on forewing situated on ventral surface in basal third near posterior margin, on hindwing situated on upper surface in basal third just behind Sc+R1 (Figs. 150-156, 159-161) 2

1'. Frenum absent (Figs. 157-158) 12

2.(1) Ventral surface of tarsomeres 1-4 with markedly enlarged, erect, blade-like or spiniform scales different from those of upper surface (Fig. 76); head scales broad, less than 5 times as long than wide (Fig. 66) .... *Areniscythris* Powell, p. 276

2'. Ventral surface of tarsomeres 1-4 with small, appressed, scales similar to those of upper surface; head scales narrow, more than 10 times as long as wide (Figs. 65, 69-70) 3

3.(2') Males 4

3'. Females 8

4.(3) Tegumen with pair of large, down-curved, beak-like processes extended from posterior margin and with ventral rows or clusters of small pegs (Figs. 173, 176, 179-180); gnathos absent .... ***Rhamphura*** , new genus, p. 255

4'. Tegumen without posterior paired, beak-like processes; gnathos present 5

5.(4') Gnathos medial, with symmetrical base, proximal arms simple and free, distal arm spine-like or thorn-like and much shorter than valvae (Figs. 185, 187-188, 193); sternum 8 markedly enlarged and extended beneath genitalia, with posterior edge produced into medial, bifurcate projection valvae relatively large, longer than tegumen (Figs. 177-178, 183-184, 192-193); valvae shaped as broad, symmetrical (twisted or curved) blades (Figs. 185-186, 187-188, 193) .... *Scythris* Hübner, p. 263

5'. Gnathos skewed leftward, strikingly asymmetrical, with left proximal arm fused to left latero-posterior edge of tegumen and with lobate protuberance (Figs. 235, 236-238, 240-243, 245-252, 257, 259-262), distal arm as long as, or longer than, valvae, rod-like (Figs. 236-238), clavate (Figs. 240-243, 248), hook-like (Figs. 249, 257, 259), in some species ventrally bent and extended below ventral plane of genitalia (Figs. 248-249, 257, 259), membranous (Figs. 233-234), or absent (Fig. 247); sternum 8 undifferentiated from preceding sterna, or if differentiated and enlarged then posterior edge not produced into bifurcate projection; valvae relatively small, shorter or barely longer than tegumen, strikingly asymmetrical and lobate (Figs. 234, 239, 244, 247-248, 261), or symmetrical and narrow, rod-like (Figs. 250, 258).... 6

6.(5') Bulbus ejacularotius as large as, or larger than, genitalia, coiled or broadly ovoid in outline (Figs. 233, 239, 244)................*Asymmetrura* new genus (in part), p. 285

6'. Bulbus ejaculatorius much smaller than genitalia, crescentic or ellipsoid in outline (Figs. 247-249, 257)..7

7.(6') Apex of distal arm of gnathos markedly dilated, club-shaped and spinose (Figs. 240, 243, 248), or simple, straight and rod-like (Figs. 233,236, 238), or absent (Figs. 245-247).....................................*Asymmetrura* new genus (in part), p. 285

7'. Apex of distal arm of gnathos hook-like (Figs. 249, 257, 259)........................... ....*Neoscythris* new genus, p. 295

8.(3') Surface of S7 uniformly smooth, unmodified, posterior edge of S7 rounded or straight, unmodified; sterigma as blunt or rounded cone with base attached on posterior third of S8 and with apex projected anteriorly or ventro-anteriorly (Figs. 316-317)...*Rhamphura* new genus, p. 255

8'. S7 modified as follows: surface with longitudinal groove or shallow medio-transverse invagination or concavity (*e.g.* Figs. 340-342), and/or posterior edge narrowly emarginate (*e.g.* Figs. 304, 309, 310), deeply incised or variously projected (*e.g.* Figs. 332, 334, 336, 338); sterigma shaped as cone situated on intersegmental membrane between sterna 7 and 8, projected out of sternal wall and with apex directed posteriorly (*e.g.* Figs. 333, 335, 337, 339, 343), or as plate or sclerotization on wall of S8 (Figs. 305, 311, 341), or undeveloped with ostium in wall of S8 (*e.g.* Fig. 307) [if ostium directed anteriorly, then posterior margin of S7 emarginate with dentate projections (Fig. 334)]..9

9.(8') Sterigma and ostium posteriorly or medially on surface of S8..........................10

9'. Sterigma and ostium on intersegmental membrane between S7 and S8..............11

10.(9) S7 with shallow longitudinal groove extended from about middle to posterior edge (*e.g.* Figs. 340, 342)..........................*Neoscythris* new genus (in part), p. 295

10'. S7 without longitudinal groove (*e.g.* Figs. 304, 309, 310)...............................
....*Scythris* Hübner, p. 263

11.(9') Posterior margin of S8 with paired, pincer-like or dentate projections, apices convergent, straight or asymmetrical (*e.g.* Figs. 332, 334, 336, 338)..................
....*Asymmetrura* new genus, p. 285

11'. Posterior margin of S8 incised, emarginate (*e.g.* Figs. 340, 342), with single subquadrate projection, or with bifurcate or paired projections with apices divergent
....*Neoscythris* new genus (in part), p. 295

12.(1') Males...13

12'. Females..21

13.(12) Inner cavity of tegumen with single, elongate, sausage-like, glanduliform, transluscent structure opening between socii (Figs. 294-295, 297).. *Commodes* new genus, p. 370

13'. Inner cavity of tegumen without sausage-like, glanduliform structure................14

14.(13') Tegumen very narrow in lateral aspect, reduced to a C-shaped sclerotized band (Fig. 268).. *Hyalinixys* new genus, p. 312

14'. Tegumen broad in lateral aspect, subtriangular, subcrescentic or suboval in outline (Figs. 267, 272, 277, 282, 285, 289, 299)..15

15.(14') Aedeagus extremely elongate, almost as long as abdomen and extended far cephalad of tegumen, harpoon-shaped with ventral row of pre-apical, recurved barbs (Figs. 299-290).,.. *Oncoxystus* new genus, p. 359

15'. Aedeagus shorter than, or subequal to, genitalia in length, variously shaped but not harpoon-like, without row of pre-apical barbs..16

16.(15') Apical part of T8 dorsally covered with dense, short, semi-erect setae (Fig. 302), or apex with very compact cluster or tuft of short, non-dehiscent scales forming a "brush" .... *Serangites* new genus, p. 380

16'. Apical part of T8 bare or covered only with regular, slender, dehiscent scales [if distal portion of T8 setose, then setae on lateral margin (Fig. 293)]..........................17

17.(16') Apical part of aedeagus with dorsal bifid projection (Figs. 283-284).. *Aeciatus* new genus, p. 341

17'. Apical part of aedeagus simple, without bifid projection..................................18

18.(17') Intersegmental membrane between T8 and tegumen developed into very convex dome covering the base of the socii and gnathos and with thick lateral, ventrally directed flanges bracing the base of socii and gnathos (Fig. 277); T8 plow-like in lateral aspect, with medio-ventral curved process and with laterally compressed, wedge-shaped distal half (Figs. 280-281) .... *Arotrura* Walsingham, p. 335

18'. Intersegmental membrane between T8 and tegumen developed into flat or slightly convex hood or flap without lateral flanges (*e.g.* Figs. 266, 272); T8 hood-like or digitate in lateral aspect (*e.g.* Figs. 267, 276, 288) 19

19.(18') Socii medially fused together, broad in lateral aspect with notched apex, having a horned appearance (Figs. 285-286); juxta slender, almost as long as aedeagus (Fig. 285); aedeagus simple, slightly curved, with base roundly dilated or bulbous (Figs. 285-286).. *Mimiella* new genus, p. 351

19'. Socii distally free, narrow in lateral aspect, downcurved or ± straight and rod-like (Figs. 264, 273); juxta very short and stubby, or reduced, indistinguishable (*e.g.* Figs. 265, 274); aedeagus sinuate with base dorsally and/or laterally crested or explanate, or straight, without crest and with distal portion abruptly sigmoid (*e.g.* Figs. 267, 272).. 20

20.(19') Distal half of T8 very slender, digitate (Figs. 266-267); socii slightly incurved in dorsal aspect, with apex pointed caudally (Fig. 264); valvae simple, slender, rod-like, without cucullar lobe (Figs. 264-265, 267) .... *Colinita* Busck, p. 305

20'. Distal half of T8 relatively broad, variously lobate or emarginate (*e.g.* Figs. 275-276); socii ± straight or divergent in dorsal aspect, downcurved in lateral aspect with apex pointed ventrally (Fig. 272); valvae variously ornate with lobes and processes, broad, with densely setose cucullar lobe (*e.g.* Figs. 272-273) .... *Meniscotus* new genus, p. 322

21.(12') Origin of ductus seminalis medio-lateral on bursa, portion between accessory gland duct and vagina with a papillate appearance from very fine and dense convolutions of membrane (Figs. 361, 397) .... *Oncoxystus* new genus, p. 359

21'. Origin of ductus seminalis at posterior end of bursa, portion between accessory gland duct and vagina smooth 22

22.(21') Corpus bursae sausage-like with anterior third or half U-bent (*e.g.* Figs. 393, 395) 23

22'. Corpus bursae straight, with anterior portion variously dilated (*e.g.* Figs. 394, 396, 398-400) 24

23.(22) S7 elongate-linguiform with posterior half extended above and covering anterior half of S8; ostium concealed in ventral aspect between posterior half of S7 and anterior half of S8, facing dorsally and surrounded by ring-shaped sterigma (Figs. 345-346) .... *Colinita* Busck, p. 305

23'. S7 ± trapezoid, not extended above S8 (*e.g.* Figs. 351); ostium exposed in ventral aspect, facing ventrally at anterior end of U-shaped or funnel-shaped sterigma (*e.g.* Figs. 352) .... *Meniscotus* new genus, p. 322

24.(22') S6 very narrowly transverse with postero-lateral angles extended into elongate flanges laterally surrounding S7 and part of S8 (Fig. 347) .... *Hyalinixys* new genus, p. 312

24'. S6 broad, subquadrate or rectangular, without postero-lateral flanges and not laterally surrounding S7 nor S8 25

25.(24') Papillae anales somewhat globuleus and apically lined with a pair of markedly sclerotized, lamellar ridges (Figs. 357-358) .... *Aeciatus* new genus, p. 341

25'. Papillae anales dorso-ventrally flattened, without apical sclerotized ridges 26

26.(25') Ostium at apex of an elongate, proboscis-like sterigma projected out of intersegmental membrane S7-S8 and extended above, and almost as long as, S8 (*e.g.* Fig. 353) .... *Mimiella* new genus, p. 351

26'. Ostium and sterigma on surface of intersegmental membrane S7-S8 or of S8, sterigma plate-like, ridge-like or short and stubby conical protrusion (*e.g.* Figs. 363, 366, 371) 27

27.(26') Surface of S6 anteriorly or medially with a bulbous invagination, pit-like depression or rounded protuberance (*e.g.* Figs. 369-370).......... *Serangites* new genus, p. 380

27'. Surface of S6 smooth, unmodified 28

28.(27') Ostium very wide; posterior section of ductus bursae broadened into funnel-shaped antrum with widest part near ostium (Fig. 363); S7 divided into two halves by deep medio-longitudinal groove (Fig. 362); S8 elongate with anterior part fishtail-like, surface with very fine, pointed microsculpture and with fine, sparse setae (Fig. 364) .... *Arotrura* Walsingham, p. 335

28'. Ostium very small; posterior section of ductus bursae narrowest near ostium, slightly widened some distance cephalad of ostium (Fig. 366); S7 divided into three sternites by two shallow sublateral grooves (Fig. 365); S8 broadly U-shaped with surface polished and asetose (Fig. 366)........................... *Commodes* new genus, p. 370

4.4 *Rhamphura* new genus

(Figs. 27-32, 83-85, 98, 116, 129, 133, 169, 172-176, 179-182, 263, 316-317, 377-378)

Type species. — *Butalis ochristriata* Walsingham, 1888, by present designation. Type repository: BMNH.

Derivation of generic name. — From the Greek *rhamphos* (= curved beak) and *oura* (= tail); given in reference to the male uncus, at the "tail end" of the body, which resembles a curved beak and characterizes members of the genus. Gender: feminine.

Recognition. — Small or medium, dark-colored scythridids at once distinguished from all other members of the family by features of the genitalia. Males are characterized by a markedly sclerotized, transverse sternum 8 with long, anteriorly directed, free apodemes extended into the abdomen (Fig. 175), Y-shaped tergum 8 with apical fan-shaped tuft of setiform scales (Figs. 174, 263), paired, beak-like processes of the posterior edge of the tegumen with ventral pegs and internal glanduliform sacs opening apically on the beak-like processes (Figs. 83-85, 173, 176, 179, 180), an articulated, U- or V-shaped vinculum (Figs. 173, 176, 179, 180), symmetrical and freely articulated valvae, a broad, medially protruded and shield-like juxtal plate and a small, very stubby, rounded aedeagus (Figs. 173, 176). Females possess a sterigma which is a stubby or flattened cone projected ventrally or anteriorly (Figs. 316-317), and an elongate, sausage-like bursa with the ductus bursae entering the bursa near the anterior end which is rounded or humped (Figs. 377-378). In external aspect specimens of several species of *Rhamphura* very closely resemble those of species of *Asymmetrura*. Males of *Rhamphura* can be separated externally from the latter by the fan-shaped arrangement of the apical scale tuft of the terminal abdominal tergum (Figs. 174, 263). Females cannot be distinguished by external features.

Description. — Description of skeletal characters of head and thorax is based on examination of specimens of an undescribed species.

Habitus. Small to medium-large, moderately stout scythridids.

Coloration. Predominantly dark-colored, olive-brown, brown or grey-brown; forewing upper surface variously suffused with pale grey, whitish or ochreous (Figs. 29-30), in some species pale suffusion forming ± distinct patches or spots (Fig. 31), in several species with ± distinct pale plical streak in proximal half (Figs. 27-28); in some species forewings dark, immaculate with slight brassy lustre. No marked color differences between sexes.

Head (Fig. 98). Head and its appendages as in *Asymmetrura* except as follow: interocular index 0.60; antennal scape with small, tufted pecten of 1-4 scales near base; flagellum short, with 23-35 articles; maxillary palpi as in *Arotrura* ; labial palpi as in *Arotrura*, LP/HH = 1.94.

Thorax. Prothorax as in *Scythris* except: pronotum and sternum with indistinct median carina; sternum ventrally narrowed, triangular, sterno-furcal joint very thin, almost membranous; intercoxal lamella not developed; propleural apodeme broad, flange-like.

Mesothorax as in *Scythris* except: epimeron subrectangular, with trans-epimeral sulcus sharply defined, delineating internally ridged dorsal margin, connection with dorsal epimeral arm narrow (Fig. 129); upper sector of precoxal suture absent (Fig. 116); pre-episternum without transluscent area (Fig. 116); secondary apophysis of lateral arm of furca narrow and longer than wide.

Metathorax as in *Scythris* except: Metascutum with lateral impression. Metascutellum more markedly transverse, narrower, lateral margins concave. Intercoxal lamella absent (Fig. 133). Katepisternum extremely small. Metepimeron extremely narrow, traversed by marked trans-epimeral sulcus, dorsal arm markedly broadened, convex.

Legs as in *Scythris* except without additional pre-apical spine on tarsomeres.

Wings. Forewing lanceolate, broadest in middle, FL/FW = 4.1-4.6, markedly broader than hindwing, FW/HW = 1.6-1.8, apex acute, termen markedly sinuate. Hindwing narrowly lanceolate, broadest near base or medially, HL/HW = 5.4-6.4, apex pointed, hind margin straight of sinuate. Venation as in *Scythris* except: forewing with distance R1-R2 1.5-2.0x distance R2-R3; hindwing with M2 and M3 separate, CuA1 and CuA2 very short, less than 0.3x length of M1. Retinaculum of females and frenum as in *Scythris* . Frenulum in males with one bristle, in females with two bristles.

Male abdomen. T1-T2 (Fig. 169) structure as in *Scythris* except suture zone without medial fold, in some species T2 margin produced into internal ridge; sclerotized area of T1 covering posterior two-thirds of tergum. T2-T7 sclerotized and darkly melanized, transversely rectangular and unmodified, with fine, sclerotized rim-like anterior margin. T8 membranous except for narrow, median, Y-shaped, markedly sclerotized band, diverging arms of "Y" directed anteriorly (Figs. 174, 263), in one species (*R. immunis*) with only transverse, sinuate, margin-like rim; posterior edge membranous, infolded, lip-like, with apical brush of hair-like scales disposed in fan-like arrangement or in very compact bundle. S2 with relatively long anterior apodemes about 0.30-0.50x length of sternum, without venulae (Fig. 172) or, in few species, with trace of venulae much shorter than apodemes; apodeme bases proximate, separated by distance less than their length, or seaprated by distance greater than their length; sternal surface as sclerotized as corresponding tergum, anterior half between apodemes smooth, unscales, relatively flat, in some species posterior half of sternum with two broad, shallow concavity. S3-S7 as sclerotized as S2, anteriorly unmargined, unmodified. S8 strikingly modified and thickly sclerotized, transverse, with antero-lateral angles prolonged into thick, apically incurved apodemes extended into abdominal cavity to about level of anterior margin of S7 or S6, caudal edge inflexed, postero-lateral angles sublobate.

Male genitalia. Symmetrical. Tegumen separated into two lateral halves joined postero-dorsally by narrow transverse bridge, in dorsal aspect anteriorly with deep, broad, U-shaped emargination, medio-posteriorly with longitudinal slit just caudad of transverse bridge, sides of slit slightly elevated or ridge-like, with ragged edges; in lateral aspect (Figs. 173, 176, 180) each half with anterior part subrectangular or subtriangular in outline, posteriorly with striking, large, variously downcurved and elongate, beak-like process protruded caudally or ventro-caudally (Figs. 183-184); anterior edge narrowly margined, ventrally produced into distinct, narrow, rod-like or stem-like predunculus; latero-ventral edge between pedunculus and base of beak-like process narrowly inflexed and, in many species, internally with small, mesially protruded lobe or point forming additional articulation (in addition to that of pedunculus); in dorsal aspect tegumen with beak-like processes having the appearance of a clamp; beak-like processes laterally compressed, almost straight or variously downcurved, dorso-medially convex or humped, markedly so in several species, and with dense cluster of stiff, erect setae, ventrally with rows or cluster of small, darkly sclerotized, tooth-like pegs (Figs. 84-85), latero-basally with patch of fine, sparse setae, apex pointed; pre-apical part of process oblique, wedge-shaped, with small orifice (Figs. 83-84) constituting opening of very fine, transluscent, indistinct, internal duct extended anteriorly into tegumen where broadened into ovoid, membranous, glanduliform sac with wall covered with minute ampulla-like structures (Figs. 173, 176, 180). Uncus and gnathos absent; anus situated between base of beak-like processes of tegumen just ventrad of medio-posterior slit of tegumen (Fig. 173). Vinculum as narrow, V- or U-shaped ring in anterior aspect (Fig. 179), with arms pointed dorsally and apically articulated onto pedunculi; in lateral aspect narrow, bent posteriorly, with subapical, mesially directed process fused to side of juxta (Figs. 173, 176, 180); saccus not developed. Valvae with base free, articulated onto vinculum, symmetrical and incurved in dorsal aspect, in lateral aspect basal two-thirds simple, unarmed, tubular, distal third tapered or variously dilated or lobate, with densely setose, prominent in most species, cucullar lobe on costa, apical portion pointed, bifurcate or roundly unilobate or bilobate (Figs. 173, 176, 179); in few species (*e.g. R. altisierrae*) valvae strikingly enormous relative to rest of genitalia, almost as long as abdomen with inner wall markedly concave and apices downtwisted (Figs. 180-182). Diaphragma reduced to very narrow membrane between base of beak-like processes and juxta-aedeagus. Juxta enlarged as broad, posteriorly protruded, shield-like plate occupying virtually all space between anus and base of vinculum-valvae (Figs. 83, 173, 176); laterally fused or hinged pre-apically on vinculum; medially markedly convex, humped or variously pointed, carinate or ridged, in many species with very fine, pointed microsculpture (Fig. 83); dorso-medially with pair of subcontiguous, heavily sclerotized, small lobes laterally flanked by smaller, membranous, finely setose lobes (Fig. 180). Aedeagus deeply recessed under tegumen, very short, stubby, dorsally humped, almost bulbous in lateral aspect with posterior edge deeply and narrowly sinuate and having the appearance of a gaping mouth (Figs. 173, 176, 179); base antero-ventrally expanded into vertical, laterally flattened, rudder-like plate fused to medio-dorsal part of juxta just cephalad of pair of heavily sclerotized lobes of the latter; phallotreme situated in deepest part of sinuation of posterior edge (in lateral aspect) (Fig. 173), facing ventro-caudally or ventrally; bulbus ejaculatorius moderately developed, about twice size of aedeagus, ellipsoid or ovoid in outline (Figs. 173, 180), anteriorly with small protruded point.

Female abdomen. Segments 1-6 as in males, in some species (*e.g. R. altisierrae*) T6 quadrate, about half width of S6. T7 elongate-rectangular, laterally sinuate, up to 3x length of preceding tergum. S7 in most species lightly sclerotized, sclerotized area indistinctly demarcated, medially divided by longitudinal membranous band, posterior margin broadly and shallowly V-emarginate; in some species (*e.g. R. altisierrae*) heavily sclerotized, antero-lateral angles somewhat produced.

Female genitalia. T8 elongate-rectangular or subquadrate, anterior edge narrowly V-emarginate in some species, surface lightly to moderately sclerotized with distinct or indistinct isodiametric microsculpture, in some species membranous except for narrow band along anterior and lateral edges; posterior edge lined with several short setae; in few large species (*e.g. R. altisierrae*) T8 very elongate-rectangular and narrow, slides medially constricted, distal half medially membranous with very fine pointed microsculpture, laterally with distinct isodiametric microsculpture. S8 membranous except for sterigma, membrane longitudinally wrinkled or striate, in many species elevated around sterigma. Sterigma medially in posterior third of S8, as markedly sclerotized cone projected off sternal wall (Figs. 316-317), cone slender and flattened, or broad, rounded and stubby, in some species very small, in many species arising from oval or shield-like basal plate extended in plane of S8 just caudad of sterigma, in many species with small cluster of setae on each side of basal plate; cone with apex characteristically projected ventrally or ventro-anteriorly. Ostium minute, at apex of cone of sterigma. Ductus bursae very fine, entirely membranous, inception laterally near apex of anterior, rounded portion of bursae. Corpus bursae (Figs. 377-378) large, very elongate, ± sausage-like, in most species anterior quarter or so dilated, rounded or humped; posterior part gradually or abruptly constricted into ductus seminalis, in some species with broad, longitudinal crenulations or bands. Spermatheca as gradually broadened, curved tube with abrupt anterior constriction or bend demarcating ovoid, head-like anterior part (Fig. 378); ductus spermathecae not coiled. Anterior apophyses relatively short, about 1.5x elngth of T8 (except in *R. altisierrae* where slightly shorter than very elongate T8), straight or with anterior portion sigmoid, parallel or slightly divergent, arising from anteo-lateral angle of T8. Posterior apophyses much thinner than and about 1.5-2.0x length of anterior ones, in some species arising from small, lightly sclerotized, oval plate of lateral wall of papillae anales. Ovipositor relatively short, about 0.25-0.35x length of T1-T7 (appearing much longer in *R. altisierrae* due to very elongate 8th segment and intersegmental membrane between segments 7 and 8); papillae anales membranous or lightly sclerotized, parallel-sided or markedly tapered and apically subpointed, laterally or dorsally and laterally sparsely setose, ventral surface with rather marked, fine longitudinal striae.

Monophyly and relationships. — Monophyly of *Rhamphura* is indicated by the paired, beak-like processes of the posterior edge of the tegumen, each with pegs on the ventral surface and with an inner, glanduliform sac opening apically, very short, stubby, bulbous aedeagus, broad, shield-like, medio-posteriorly protruded juxta, Y-shaped tergum 8 with a caudal, fan-shaped "brush" of setiform scales, and transverse sternum 8 with a pair of thick anterior apodemes. *Rhamphura* is a markedly autapomorphic genus and does not appear to be related to any scythridid group from the northern Hemisphere. Placement of this genus at the beginning of the classification reflects retention of primitive features of the male genitalia, notably the unmodified, gelechioid vinculum with the saccal region oriented ventro-cephalically, and free valvae. Three undescribed Patagonian species (specimens in ZMUC and in CNC) possess paired glanduliform structures extended into the tegumen cavity, somewhat analogous to those present in *Rhamphura* but lack the paired, beak-like processes of the tegumen. If these structures are synapomorphic, then the sister group of *Rhamphura* should be found in South America.

Included species and generic diversity. — The following species are here transferred from *Scythris* (*sensu* Hodges *et al.* 1983) to *Rhamphura* :

Rhamphura altisierrae (Keifer, 1937: 186), **new combination**; California.

Rhamphura immunis (Meyrick, 1916: 13), **new combination**; Peru.

Rhamphura ochristriata (Walsingham, 1888: 115), **new combination** and type species; California.

Rhamphura perspicillella (Walsingham, 1888: 114), **new combination**; California.

Rhamphura suffusa (Walsingham, 1888: 114), **new combination**; California.

In addition I have examined specimens of 26 undescribed species from North America and Mexico, and of six undescribed species from Central and South America.

Geographical distribution. — Apparently a New World endemic group known from both the Nearctic and Neotropical regions. In North America, the genus is widely distributed but most diverse in the mountainous parts of the West. A few undescribed species barely reach into southermost Canada. *S. immunis* Meyrick is presently the only described species from the Neotropical region, but I have seen specimens of a few undescribed forms from Chile and Central America. The group might be well represented throughout the Andean regions but material from those regions is scarce due to inadequate collecting.

Natural history. — Known hostplant records from reared specimens indicate that different members of the genus feed on a wide variety of plants belonging to different families: *Lupinus albifrons* Benth., Leguminosae (*R. ochristriata*); *Lupinus sp.* (undescribed species from Washington State); *Solanum Xanthii* Gray, Solanaceae (*R. altisierrae*); *Perideridia Bolanderi* (Gray) Nels. & MacBr., Umbelliferae (undescribed species from Idaho); *Cardionema ramosissimum* (Weinm.) Nels. & MacBr., Caryophyllaceae (undescribed species from El Segundo sand dunes, California); *Cirsium sp.* , Compositae (undescribed species from eastern United States). No hostplant record is available for Neotropical species. No data are available on hostplant specificity, or lack thereof.

Larvae of *R. ochristriata* make rather extensive webs on the foliage of the host plant in late summer (J.A. Powell, pers. comm. 1987). Larvae of *R. altisierrae* skeletonize the upper surface of leaves under a web (Keifer 1937: 187). Adults of all species appear to be diurnal and have been frequently collected at various flowers. Several undescribed species occur at high elevations and some have been found in alpine meadows in the Rocky Mountains. Adults of one such species from Colorado were observed running on the ground, hopping or entering crevices and between rocks to escape (R.W. Hodges, pers. comm. 1982).

4.5 *Scythris* Hübner

(Figs. 1-7, 95, 97, 110-112, 114-115, 138, 141, 150-151, 156, 168, 177-178, 183-190, 192-193, 304-311, 372-374)

Scythris Hübner, 1825: 414. — Type species: *Tinea chenopodiella* Hübner, [1813], by subsequent designation (Walsingham 1909: 51). Type repository: type lost; [name a junior subjective synonym of *Tinea limbella* Fabricius, 1775 (Karsholt & Nielsen 1976); type repository: ZMUC.

Galanthia Hübner, 1825: 417. — Type species: *Galanthia extensella* Hübner, 1825, author of designation not found. Type repository: type lost; [= *Phalaena obscurella* Scopoli, 1763].

Butalis Treitschke, 1833: 110. — Type species: *Tinea cuspidella* Denis & Schiffermüller, 1775 (P. Passerin d'Entrèves, pers. comm. 1985), author of designation not found. Type repository: unknown to me; name pre-occupied by *Butalis* Boie, 1826, Aves.

Copida Sodoffsky, 1837. — Replacement name for *Butalis* Treitschke, 1833.

Derivation of generic name. — From the Greek *scythros* (= sullen, angry); probably given in reference to the sullen look of the face of members of the genus, somber coloration of members of most European species, and forbidding, uniform external appearance of the moths which baffled early systematists (Le Marchand 1938). Gender: feminine.

Recognition. — Nearctic members of *Scythris* in the restricted sense used here all possess a markedly enlarged sternum 8 which extends beneath the male genitalia and has a variously developed, apically bifurcate, posterior projection (Figs. 177-178, 183-184, 192-193); the rest of the male genitalia is of normal, symmetrical construction but the vinculum is a triangular or U-shaped plate that extends caudally beneath the genitalia (Figs. 185, 187, 193). No shared feature of the genitalia is known to collectively separate females of *Scythris* from those of other Nearctic scythridids.

Nearctic members of the genus as here restricted are varied in size and coloration. Large, pale species like *S. mixaula* (Figs. 3-6) and an undescribed, related species closely resemble specimens of *Arotrura*, *Aeciatus*, some *Meniscotus*, *Mimiella* and *Serangites*, but are easily distinguished from them by their reduced haustellum and/or male genitalia feature as indicated above. Females of these two species of *Scythris* also possess a frenulum with three bristles, whereas there are only two frenulum bristles in females of the other genera. Dark, immaculate species such as *S. immaculatella* (Fig. 7)resemble some *Asymmetrura* and *Rhamphura*. Specimens of the type species *S. limbella* (Figs. 1-2) have a very distinctive forewing maculation which separates them from all other Nearctic scythridids.

Description. — Description of skeletal characters of head and thorax is based on examination of specimens of *S. limbella* and of *S. mixaula*.

Habitus. Small to very large, relatively stout scythridids.

Coloration. Various: predominantly dark-colored, olive-brown or dark grey, body with some cream-color or whitish suffusion, forewings immaculate or scatteringly suffused (*S. immaculatella*) (Fig. 7) or with irregular whitish or cream-color markings (*S. limbella*) (Fig. 1-2); or predominatly pale-colored, white or ivory-white with forewings nearly immaculate or variously finely streaked with brown or grey (*S. mixaula*) (Figs. 4-6). Hindwing paler than or almost as dark as forewing, in some species with area devoid of scales in basal third; in *S. limbella*, sexes with striking color differences on dorsal surface of abdomen.

Head (Figs. 95, 97). Face about as high as wide, or higher than wide, in profile moderately broad and convex. Eyes large (Fig. 95) or very large (Fig. 97), interocular index 0.78-1.07, moderately or markedly bulbous, suborbicular in outline, barely or markedly extended below fronto-clypeal ridge, antero-dorsal margin indistinctly or distinctly sinuate. Scales very thin, narrow, more than 10 times longer than wide, apex notched, truncate or rounded (as in Figs. 69-70). Fronto-clypeal ridge straight, or slightly or markedly convex. Transfrontal sulcus distinctly delineated, impressed or not impressed. Gena narrow or moderately broad, bare. Pilifers distinctly developed, slightly protruded below fronto-clypeal ridge. Occipital ridge angulate or rounded; occipital sulcus obsolete and indistinct, or well impressed and distinct. Temporal sulcus indistinctly impressed or absent. Postgena narrow in lateral aspect. Ocelli present (Figs. 95, a, b) or absent (Figs. 97, a, b). Haustellum very long, extended to middle of abdomen and distinct when coiled, or very short, extended to prothorax and indistinct when coiled. Antenna filiform, extended to two-thirds of forewing; scape with dense pecten of 15-30 scales extended to three-quarters of length of scape; flagellum with 29-38 articles, ventrally densely ciliate, in some species (*e.g. S. mixaula*) cilia longer than width of articles. Maxillary palpi (Figs. 95, 97, d) with four articles, folded over base of haustellum, in some species reduced and inconspicuous. Labial palpi (Figs. 95, 97, c) with appressed scales, upcurved, moderately long and extended to level of vertex or base of antenna (most species), or porrect or slightly drooped (*S. immaculatella*), LP/HH = 1.86-2.12; article 3 about 0.75x length of article 2.

Thorax. Prothorax (Figs. 110-112). Pronotum (Fig. 110) well sclerotized, broad, transversely arched, medially with distinct or indistinct longitudinal carina, antero-ventral margin with median protuberance; antero-lateral margin fused with dorsal margin of propleuron, noto-pleural suture distinct; median sclerite well developed and sclerotized, posterior portion transverse. Pre-episternum with prominent but narrow lateral lobes. Propleuron with well developed pleural "wart", inner margin antero-dorsally bent inwardly, antero-dorsal angle prolonged into posteriorly-directed apodeme (*e.g. S. limbella*) or lamina (*e.g. S. mixaula*), outer margin straight, not bulged at level of wart. Sternum (Fig. 110) relatively narrow, subquadrate or subtriangular and ventrally narrowed, precoxal bridge well sclerotized, joined to anterior margin of propleuron with distinct sterno-pleural suture; medial area concave, with complete or incomplete, or without, median longitudinal carina; ventral apex of sternum lightly sclerotized or membranous, thinly attached to furcal process, or sterno-furcal joint membranous. Furcal apophysis (Fig. 112) with or without dorsal, crested intercoxal lamella; sterno-pleural bridge (Fig. 111) laterally broadly fused to posterior margin of pleuron, pleural suture thin but distinct, latero-ventral margin of bridge abruptly sinuate, latero-ventral corner produced; furcal apophysis short; posterior margin of furca evenly rounded or produced just beneath apophysis. Patagium (Fig. 110) moderately sclerotized, transverse, crescentic. Parapatagium (Fig. 110) moderately sclerotized, very narrow (less than half width of patagium), crescentic, with or without small, dorsal, peg-like protuberance.

Mesothorax. Trans-epimeral sulcus complete, demarcating oval area, dorsal arm of epimeron broadly connected to oval area. Precoxal suture (Figs. 114-115) incomplete, medially interrupted, upper sector distinct, lower sector curved mediad. Pre-episternum with or without (Figs. 114-115) transluscent area around anterior portion of lower sector of precoxal suture. Margino-pleural suture distinct, abbreviated or extended to apex of upper sector of precoxal suture thus demarcating small triangular area on katepisternum (*e.g.* some specimens of *S. limbella*) (Figs. 114). Lateral arms of furca with short and broad, apically bifurcate, secondary apophysis.

Metathorax. Metascutum with or without lateral impression. Metascutellum transversely trapezoid, lateral margins oblique, straight. Intercoxal lamella present, well developed. Metepimeron partly traversed by incomplete, obsolete trans-epimeral sulcus, dorsal arm narrow. Furcal apophysis (Fig. 138) low, attached subapically to furcal process, anterior projection very small, pointed, projected antero-dorsally and, in dorsal aspect (Fig. 141), extended laterad of process, or broad, somewhat rounded and projected dorsally.

Legs. Tibial spurs 0-2-4, inner spur of each pair longer than outer one and about 0.3x length of tibia. Foretibia with well developed epiphysis about 0.25x length of tibia. Tarsomeres 1-

4 ventrally with two apical spines, in some specimens of *S. limbella* with one additionnal shorter, pre-apical spine on some tarsomeres (as in Fig. 80).

Wings (Figs. 150-151, ~~156~~). Forewing lanceolate, broadest in middle, FL/FW = 3.7-5.8, slightly to markedly broader than hindwing, FW/HW = 1.2-1.9, apex pointed or acute, termen indistinctly or distinctly sinuate. Hindwing lanceolate or narrowly lanceolate, broadest medially or in basal third, HL/HW = 4.6-6.8, costa straight (Fig. 150) or indistinctly bulged in basal third, (Fig. 156) termen slightly sinuate (Figs. 150-151) or straight (Fig. 156). Forewing with 12 veins; Sc terminated at or before middle of costa; R1 attached slightly or markedly beyond middle of Rs, closer to R2 than to base of Rs, distance R1-R2 about 2.5-3.0x that between R2-R3; R4+5 stalked, R4 to costa, R5 to termen; medial branches distinct to margin, M3 and CuA1 connate, distinct or obsolete; M2 and M3+CuA1 separate or forked; CuP distinct or obsolete at hind margin, short, subequal to, or shorter than, CuA2; fold proximate to cubitus stem from base of wing to middle of cell; 1A+2A forked basally, 1A obsolete; cell closed; pterostigma absent. Hindwing with 7 or 8 veins; Sc+R1 parallel to Rs and extended to about middle of costa or distinctly beyond middle of costa and base of M1; Rs straight or slightly curved beyond base of M1, separate from M1; origin of M1 shortly beyond middle of Rs, connected to Rs by very short transverse or oblique cross-vein, and subparallel or slightly divergent from distal sector of Rs; M2 and M3 separate, stalked, or connate and forked with CuA1; base of M2 or of M2+M3 ± in line with or situated beyond, base of CuA1, or distinctly extended anterior to base of CuA1; CuA1 and CuA2 long, at least 0.5x length of M1, or short, less than 0.25x length of M1; CuP absent or present, obsolete and longer than CuA2; 1A+2A basally forked, obsolete, unmelanized but distinctly convex; cell closed. Retinaculum of females with "subcostal" unit of narrow, blade-like, semi-erect scales in row on base of Sc and with "cubital" unit of similarly shaped scales on Cu base and scattered in area between base of Rs and of Cu. Frenulum in males with one bristle, in females with two (Fig. 151) or three (Fig. 150) bristles. Frenum present.

Male abdomen. T1-T2 suture singly margined by T2 anterior margin, T1 with sclerotized medial fold anteriorly lining T1-T2 suture zone (Fig. 168). T2 with surface lightly sclerotized. T3-T7 membranous to moderately sclerotized, transversely rectangular and unmodified, with fine, sclerotized anterior margin. T8 moderately sclerotized, moderately to markedly differentiated from preceding terga: subtrapezoid and smaller in area than T7 (*e.g. S. limbella*), or narrowly elongate, larger in area than T7 and with posterior margin with deep U-emargination (*e.g. S. mixaula*) (Fig. 190). S2 with pair of hollow anterior apodemes 0.10-0.20x length of sternum, venulae absent or present as obsolete, indistinct, longitudinal, sclerotized bands extended to one third or half of sternum (± as in Fig. 171); sternal surface lightly sclerotized, anterior half of sclerotized area smooth, unscaled, somewhat convex or elevated. S3-S7 moderately sclerotized, anteriorly unmargined, unmodified, in some species with median area irregularly membranous. S8 markedly sclerotized, enlarged, strikingly differentiated from preceding sterna, extended beneath genitalia (Figs. 177-178, 183-184, 192-193), in ventral aspect subtriangular, very elongate-triangular or narrowly elongate-rectangular in outline (Figs. 177, 184, 192), convex, anterior edge shallowly emarginate, antero-lateral corner dorsally produced and surrounding basal part of genitalia (Fig. 193), posterior margin medially projected, projection bifurcate, variously extended from much shorter than rest of sternum (Fig. 184) and slightly upcurved to as long as or longer than sternum and markedly upcurved (Figs. 178, 193).

Male genitalia (Figs. 185-189, 193). Symmetrical, of normal gelechioid construction with all parts present and recognizable (*i.e.* tegumen, uncus, gnathos, vinculum, valvae and aedeagus). Tegumen hood-shaped, in dorsal aspect (Figs. 186, 188) of elongate-trapezoid outline, sides convex, straight or inflexed, anterior edge deeply and broadly V-emarginate, emargination extended to half or three-quarters of length of tegumen, edges of anterior emargination margined, in some species (*e.g. S. limbella*) (Fig. 186) continued on distal part as median longitudinal suture extended to posterior edge; in some species (*e.g. S. immaculatella*), posterior part of tegumen laterally constricted and apical part bilobate; posterior edge straight or shallowly V-emarginate; in lateral aspect (Figs. 185, 187, 193), tegumen slender in outline, elongate-suboval, subelliptic or subtriangular, extended posteriorly above basal third or half of valvae; pedunculi only slightly differentiated from tegumen by tapered ventral part of tegumen, articulated to latero-dorsal process of vinculum and/or to dorsal angle of extreme base of valvae. Uncus well developed, in dorsal aspect (Figs. 186, 188) U-shaped or horseshoe-shaped with arms projected caudally, arms almost straight (*e.g. S. mixaula*) or markedly incurved (*e.g. S. limbella*), ventro-laterally sparsely setose, surface smooth or irregularly ridged; in lateral aspect (Figs. 185, 187, 193), uncus slender and ± parallel-sided or slightly tapered (*e.g. S. limbella*), or with ventral edge markedly sinuate, dentate or lobate with apex pointed (*e.g. S. immaculatella*). Gnathos: in *S. limbella* , asymmetrical with right proximal arm curved transversely to join left proximal arm on left side (in caudal aspect), both proximal arms relatively heavy, single distal arm sigmoid in lateral aspect, apically acuminate and slightly displaced leftward in sagittal plane of left proximal arm (Figs. 185-186); in other species, gnathos symmetrical, proximal arms very short, distal arm as heavy, ventrally pointed, thorn-like projection, projection simple (*S. immaculatella*) (Fig. 193) or with lateral dentiform process and spear-shaped in dorso-caudal aspect (*S. mixaula* and others) (Figs. 188-189). Vinculum extended caudally beneath valvae, in ventral aspect as triangular, linguiform, U- or V-shaped plate, in lateral aspect plate somewhat sigmoid in outline or straight with anterior part flanged from ventrally protruded anterior part (Figs. 185, 187, 193). Valvae basally contiguous but free (*S. limbella*) or with inner anteriormost angles narrowly (*S. immaculatella*) or broadly (other species) fused together and to vinculum; downtwisted and distally tapered (*S. limbella*) (Fig. 185), or dilated and spatulate (most other species) (Fig. 187) or apically armed with long, slender, digitate projections (one undescribed species); costa simple, unarmed, or basally variously lobate or medially dentate; inner surface sparsely setose (Figs. 185, 193), or with dilated distal portion very densely setose (Fig. 188). Diaphragma membranous, unmodified. Juxta fused basally or sub-basally to aedeagus, as elongate flange (Figs. 185, 193) or short, subquadrate plate (Fig. 187), extended ventrally from aedeagus and articulated to point of junction or of fusion of base of valvae. Aedeagus ankylosed by juxta, narrowly tubular, slender, distally attenuate, ± straight, or slightly upcurved (Figs. 185, 187, 193); phallotreme apical; bulbus ejaculatorius small, semi-oval in outline.

Female abdomen. T1-T6 as in male. T7 twice as broad as T6, in some species transverse with antero-lateral angles prolonged as pleural apodemes attached to antero-lateral corners of S7 (Figs. 306, 309). S2-S5 as in male or almost membranous. S6 transverse, in some species antero-medially with oval, membranous "window". S7 elongate-trapezoid (Fig. 304, 309) or subquadrate (Fig. 310), most sclerotized of sterna, posterior margin with shallow medial emargination, in some species anterior margin folded, lip-like.

Female genitalia (studied in three described and one undescribed species). T8 lightly or indistinctly sclerotized, medially with narrow or broad membranous area with fine longitudinal wrinkles or striae, latero-posteriorly with few scattered fine setae, or posterior margin lined with fine setae. S8 entirely membranous, or mostly so except for sclerite of sterigma, membrane finely rugulose from very fine, pointed microsculpture (*e.g. S. mixaula*), or finely longitudinally striate (*e.g. S. immaculatella*), latero-posterior angles with few fine setae. Sterigma undeveloped (*e.g. S. mixaula*) (Fig. 307), or moderately developed, situated on S8: in *S. limbella* , linguiform with distal half slightly protruded off sternal surface and flat, extended from anterior edge of sternum (Fig. 305); in other species, as oval, concave plate situated on posterior edge of S8, plate markedly sclerotized and distinctly demarcated (*e.g. S. immaculatella*) (Fig. 311), or slightly sclerotized and diffuse (undescribed species). Ostium small or minute, in posterior third of S8, in plane of sternal wall in most species (Figs. 307, 308, 311), at apex of protruded flap in *S. limbella* (Fig. 305). [The following internal membranous parts were studied only in the three described species included here]. Ductus bursae membranous, fine, ribbon-like, inception into bursa medio-laterally, anteriorly (Fig. 372), medially (Fig. 373) or posteriorly adjacent to ductus seminalis (Fig. 374). Corpus bursae various: elongate-ovoid and slender with broadest part anterior (Fig. 373), or with broadest part medial and with anterior part U-bent (Fig. 372), or subspherical (Fig. 374). Ductus seminalis extended from posteriormost part of bursa.

Spermatheca various: ± bean-shaped with anterior part tapered (Fig. 372), ovoid, or tubular and irregularly recoiled (*S. mixaula*) (Fig. 374); ductus spermathecae with anterior (proximal) section very loosely coiled (*S. mixaula*), or uncoiled (other species). Anterior apophyses straight, parallel or divergent, moderately long, about 1.3-1.4x length of T8 (most species) or extremely short, about 0.5x length of T8 (*S. mixaula*). Posterior apophyses thinner and about 1.2-1.8x length of anterior ones, 4.0x length of anterior ones in *S. mixaula* . Ovipositor moderately or very short, about 0.15-0.30x length of T1-T7; papillae anales membranous or very lightly sclerotized, broad and parallel-sided, or narrowly tapered, sparsely setose.

Monophyly and relationships. — *Scythris* in the broad sense, that is as presently encompassed by various authors in checklists and faunal works, is an extremely heterogeneous, polyphyletic assemblage which is almost co-extensive with the family and comprises a miscellany of undescribed generic lineages. *Scythris* is here provisionally defined by the presence in males of an enlarged, subtriangular sternum 8 extended beneath the genitalia and posteriorly prolonged into a variously developed, bifurcate projection. This feature is hypothesized to be apomorphic. Although significantly restricting the number of included species, use of this synapomorphy still leaves *Scythris* intentionally broad, encompassing species with otherwise markedly dissimilar genitalia. By that definition, *Catascythris* Amsel would be congeneric with *Scythris* because males of the type species, *C. kebirella* Amsel, have a furcate S8 and genitalia with an overall aspect very similar to those of males of *Scythris* . I do not propose formal synonymy of *Catascythris* because I have only seen a partial drawing of male genitalia. Males of *Parascythris muelleri* (Mann) also possess a furcate S8, but differ in most other aspects of genitalia from males of *Scythris* .

Possession of a furcate, subtriangular sternum 8 indicates possibly monophyly at a yet undetermined supra-generic level, or is homoplastic in various unrelated groups. Members of *Scythris s. str.* are similar in possessing generally symmetrical male genitalia with normally constructed valvae, a horseshoe-shaped or U-shaped uncus, thorn-like or spear-like gnathos and simple, tubular, attenuate aedeagus, but these may all be plesiomorphic within the family.

Included species and generic diversity. — The Nearctic fauna has very few *Scythris* that are closely related to the type species and that might be included in the same genus. The described species are:

Scythris immaculatella (Chambers, 1875: 10) — western North America to Alaska and southern Appalachians;

Scythris limbella (Fabricius, 1775: 660) — introduced in eastern North America;

Scythris mixaula Meyrick, 1916: 14 — southwest and Great Plains.

In addition I have examined specimens of four undescribed species from the american west and southwest which are closely related to *S. mixaula* .

Among other described Nearctic species, the following 11 are provisionally left in *Scythris* until their relationships are elucidated. They are not related to the type species *S. limbella* nor to any of the species listed above, nor do they belong to any of the other genera recognized below. They are of uncertain generic placement within the Scythrididae:

S. anthracina Braun, 1923b: 123;

S. basilaris (Zeller, 1855: 230);

S. charon Meyrick, 1918: 156;

S. eboracensis (Zeller, 1855: 205);

S. inornatella (Chambers, 1879:), **new comb.** from *Coleophora* (Coleophoridae);

S. inspersella (Hübner, [1817]: plate 66, fig. 443);

S. interrupta Braun, 1920: 41;

S. noricella (Zeller, 1843: 151);

S. piratica Meyrick, 1928: 414;

S. trivinctella (Zeller, 1873: 92);

S. ypsilon Braun, 1920: 41.

The following four nominal Nearctic species remain uninterpreted because their type material is either lost or was not available for study, and the original description are insufficient to establish their identity or even to establish whether they are true scythridids. I consider them as *nomina dubia* until their identity is elucidated:

S. albilineata (Walsingham, 1888: 116), *nomen dubium* ;

S. brevistrigella (Chambers, 1875: 53), *nomen dubium* ;

S. dorsipallidella (Chambers, 1875:: 10), *nomen dubium* ;

S. pilosella (Zeller, 1873: 93), *nomen dubium* ;

Scythris s. str. is a predominantly Palearctic genus with most of its described species occurring in western Europe, where there are about 50 species. At present I am unable to ascertain the generic limits on a world basis. In addition to not having seen representatives of many of the Old World species, many nominal species placed in *Scythris* by their original authors remain to be studied and their type examined to check their identity. This is being done by Passerin d'Entrèves (1974, 1976, 1977, 1979, 1980) for Palearctic and Afrotropical species. I have studied representatives of*S. immunis* Meyrick, *S. medullata* Meyrick, *S. notorrhoa* Meyrick and *S. tibicina* Meyrick from South America and photos of genitalia (from Clarke 1965: 573-582) of the eight other described Neotropical species. Of these, only *S. fluvialis* Meyrick from Colombia may belong to *Scythris* as here restricted but I refrain from assigning it formally until I have actually examined specimens. None of four undetermined Australian species for which I have examined specimens is related to *Scythris* as here restricted. The only Oriental species examined, *S. sinensis* (Felder & Rogenhofer) from Siberia, China, Japan and Korea, is not a *Scythris s. str.*, as is not *S. chrysopygella* Caradja from China (genitalia of the latter figured in Sattler 1971).

The type species of *Galanthia* Hübner and *Butalis* Treitschke (= *Copida* Sodoffsky) are closely related to the type species of *Scythris* (males of both species possess a furcate S8 and overall similar genitalia) and I agree with other authors (Bengtsson 1984: 27, Leraut 1980: 73) about the validity of the generic synonymy indicated above. *Arotrura* Walsingham, 1888 and *Colinita* Busck, 1907, previously considered junior synonyms of *Scythris* Hübner (Walsingham 1909: 51-52, Busck 1909: 97, Barnes and McDunnough 1917: 189, McDunnough 1939: 91, Hodges *et al.* 1983: 19) are here removed from synonymy and their generic status is re-established (see sections 4.9 and 4.12).

This study presents the first attempt at restricting the genus *Scythris* . Restriction of *Scythris* as construed here is tentative and applies principally to New World species. The concept will obviously require modification when a more comprehensive picture of the Old World fauna emerges and distribution of character states becomes better known. The present preliminary assessement was however logically necessary in order to describe a series of new genera, transfer species from *Scythris* to the latter and remove generic names from synonymy. Because *Scythris s. str.* appears so predominantly Old World in distribution, it is not critical at this stage to circumscribe it comprehensively in order to classify the New World fauna.

Geographical distribution. — Known from the Nearctic, Palearctic and Afrotropical (northern Africa) regions. It is uncertain whether several Asian and Australian species presently included in *Scythris* in the broad sense are truly congeneric with *S. limbella* . The restricted genus is most diverse in the western Palearctic region, but it is not known whether predominance in that part of the Old World reflects better collecting than in other parts of the region. In the New World however the group appears to have but a few representatives.

Natural history. — Among Nearctic species, larvae of the introduced *S. limbella* feed on *Atriplex sp.* and *Chenopodium sp.* (Chenopodiaceae) gregariously in slight silken webs on leaves, flowers or buds. Larvae of *S. mixaula* and of a closely related, undescribed species feed on *Opuntia sp.* (Cactaceae) and on other undetermined cacti. *S. trivinctella* has been reared from *Amaranthus retroflexus* (L.) (Amaranthaceae). In western Europe, species of *Scythris s. str.* are known to feed on Polygonaceae (*Rumex*), Chenopodiaceae (*Chenopodium* , *Atriplex*) and Caryophyllaceae (*Scleranthus* , *Silene* , *Cerastium*).

Adults of most species are diurnal, but those of *S. mixaula* and of some other undescribed species occurring in southern United States are nocturnal.

4.6 *Areniscythris* Powell

(Figs. 22-24, 66, 68, 73-78, 81, 89-90, 103, 117, 139, 142, 155, 230-232, 331, 386)

Areniscythris Powell, 1976: 326.

Type species. — *Areniscythris brachypteris* Powell, 1976. Fixed by Powell (*loc. cit.*) by original designation and monotypy. Type repository: CAS.

Derivation of generic name. — From the Latin *arena* (= sand), and *Scythris* (name of the type genus of the family Scythrididae); given in reference to the way of life of these remarkable scythridids which inhabit open, shifting dunes where adults run on the sand. Gender: feminine.

Recognition. — Members of *Areniscythris* are at once distinguished from all other scythridids by parallel-sided body (with wings folded) (Figs. 23-24) with a more rounded apex, small, oval eyes posteriorly and ventrally completely surrounded by the broad, scaled postgena (Fig. 68), the broad head scales which are only three to five times longer than wide (Fig. 66), the very short antennae and scape without pecten, tarsomeres 1-4 with greatly reduced pairs of subapical spurs (Fig. 81) and clusters or rows of strikingly enlarged, spiniform scales on the ventral surface (Fig. 76), the gnathos of males with lobate, markedly and darkly sclerotized proximal arms and attenuate, sigmoid distal arm (Figs. 230-231), and the ostium of females on the left side of sternum 8 on the curved part of a narrow, L-shaped sclerite (Fig. 331). Specimens of *A. brachypteris* are easily recognized by their short wings (Fig. 24).

Description. — Description of skeletal characters of head and thorax is based on examination of specimens of two undescribed species.

Habitus. Very small to small-medium, relatively stout and parallel-sided scythridids with apex (wings folded) rounded (Figs. 23-24).

Color. Ground color of dorsal surface pale drab, cream-color or olive-brown, forewing upper surface variously mottled and/or suffused with tan, brown and whitish; hindwing upper surface with disc paler than forewing and very sparsely scaled, marginal areas darker, in some species entire surface as dark as that of forewing. Ventral surface of body white or whitish. No significant color differences between sexes.

Head. Face about as wide as high, or markedly wider than high, in profile moderately or markedly broad and convex. Head integument smooth, or markedly scabrous from raised scale sockets (Figs. 77, 103a). Scales of frons and vertex moderately or markedly broadened, one to five times as long as wide, sublanceolate, suboval or oval, with apex truncate, rounded or dentate (Figs. 66, 68), in some species scales very firmly attached (difficult to scrape off with needle). Eyes (Figs. 66, 68, 103a, b) medium or small, interocular index 0.59-0.69, moderately rounded, suborbicular in outline, ventral margin about level with fronto-clypeal ridge, or not reaching ridge. Fronto-clypeal ridge slightly or markedly convex. Transfrontal sulcus moderately or markedly impressed. Gena broad, covered with scales. Pilifers (Fig. 78) barely or distinctly protruded below fronto-clypeal ridge. Occipital ridge rounded or slightly angulate; occipital sulcus distinct or absent. Temporal sulcus indistinctly marked or absent. Post-occipital region in lateral aspect flat or markedly concave. Postgena in lateral aspect narrow, very narrow or broad, surrounding posterior and ventral margins of eye. Ocelli present, in some species vestigial. Haustellum very long, extended to middle or apex of abdomen. Antenna filiform, short, extended to one third or half of forewing; scape without pecten; flagellum with 24-28 articles, ventrally densely ciliate. Maxillary palpi (Figs. 103d) with two or four articles, in some species terminal article markedly smaller than basal article. Labial palpi (Figs. 68, 103c) with appressed scales, upcurved or subporrect, short and extended to middle of frons or to base of antenna, LP/HH = 1.01-1.56, article 2 subequal in length to article 1.

Thorax. Prothorax as in *Scythris* except as follow: very darkly melanized; pronotum dorsally rounded, not shouldered, ventral margin medially with broad, rounded process, median sclerite somewhat crescentic, anteriorly without narrow "neck"; sternum narrow, flat, episternal bridge very narrow, medial carina absent, antero-medial process obsolete, sterno-furcal joint membranous; propleuron short, markedly convex in frontal aspect, antero-dorsal apodeme sharply upcurved, posterior pleural margin in lateral aspect at sharp angle with furcal apophysis; pleural suture internally strengthened by marked carina; furcal process relatively long, projected forward, with highly crested intercoxal lamella; sterno-pleural bridge and furca markedly projected posteriorly, ventral margin of furca broadly rounded; furca short and markedly sclerotized, furcal apophysis markedly incurved; parapatagia relatively broad, about half width of patagia.

Mesothorax as in *Scythris* except: very darkly melanized; epimeron subtrapezoid, with trans-epimeral sulcus sharply defined, delineating internally ridged dorsal margin, connection with dorsal-epimeral arm narrow; precoxal suture very reduced, upper sector absent, lower sector abbreviated; margino-pleural suture short; pre-episternum and katepisternum completely divided by broad, irregular, transluscent area (Fig. 117).

Metathorax as in *Scythris* except: Metascutum with little developed medial protuberance in anterior emargination, with lateral impression. Intercoxal lamella absent. Katepisternum extremely reduced in area, indistinct. Metepimeron extremely narrow, as rather heavily sclerotized longitudinal ridge. Furcal process broad in lateral aspect (Fig. 139), in dorsal aspect narrow, secondary lamina constricted at junction of secondary arms; apophysis inserted submedially, anterior projections very small, stubby, projected dorsally, posterior projections long, extended beyond secondary arms (Figs. 139, 142).

Legs. Tibial spurs as in *Scythris* except relatively longer, somewhat curved. Apex of foretibia in some species with outer side prolonged into variously elongate, blade-like (Fig. 75) or bifid projection. Epiphysis as in *Scythris* . Tarsomeres 1-4 with pair of apical spines markedly reduced, inconspicuous (Fig. 81), and with distal scales of ventral surface enlarged, modified, blade-like or spiniform, semi-erect (Fig. 76). In some species (*e.g. A. brachypteris*) combined length of hind tibia and tarsus as long as or longer than body.

Wings (Fig. 155) (except *A. brachypteris*). Forewing lanceolate, broadest in middle, FL/FW = 4.4-5.0, moderately to markedly broader than hindwing, FW/HW = 1.4-1.8, apex pointed, termen straight. Hindwing lanceolate or narrowly lanceolate, broadest near base or medially, in some species with costa slightly bulged at middle, HL/HW = 5.6-7.4, apex pointed, hind margin straight. Wing membranes thick, leathery, disc slightly melanized; in one species ventral surface of apex of hindwing with patch of setiform scales projected outwardly from apex. Venation, when developed, as in *Scythris* except as follow: forewing with R5 obsolete in some species, M2 and M3+CuA1 obsolete and forked, or M3+CuA1 absent (or connate with M2) and M2 and M1 forked with R4+5, cell open, pterostigma absent; hindwing veins developed or several veins obsolete though distinct, M2 and M3 connate, cell open. Retinaculum of females and frenum as in *Scythris* , scales of retinaculum very stiff, bristle-like with apex hooked. Frenulum in males with one bristle, in females with two, three or four bristles.

In *A. brachypteris* : forewing somewhat lanceolate, shape of apical portion somewhat paired (Powell 1976: 327, figs. 2, 3), hindwing narrowly lanceolate. Venation obsolete: forewing with Sc extended to third of costa, Rs present, markedly and variously reduced, R branches obsolete or absent, one medial branch present distally, cubital stem developed at least medially; hindwing with only two variously obsolete veins, probably Rs and Cu stem.

Male abdomen. T1-T2 suture in most species singly margined- (i.e. with only transverse margin of T2), medially sinuate or notched and internally expanded into marked ridge, in few species (*e.g. A. brachypteris*) suture thinly, doubly margined (i.e. with anterior margin of T2 and posterior margin of T1 developed and extended parallel to and slightly distant from that of T2), not medially sinuate nor internally ridged; sclerotized area of T1 covering posterior half of tergum. T2-T7 moderately or markedly sclerotized and darkly melanized, transversely rectangular or subquadrate and unmodified, with fine, sclerotized rim-like anterior margin. T8 in most species differentiated and markedly sclerotized, linguiform, anterior edge roundly emarginate, thickly margined, antero-lateral angles prolonged internally as heavy apodemes, in some species with medio-lateral pointed process extended on pleural margin (Fig. 232). S2 with well developed, long apodemes about 0.40x length of sternum, without venulae or with venulae about the length of apodemes; smooth, unscaled area behind apodemes well sclerotized, more melanized than rest of sternum. S3-S8 anteriorly unmargined, in most species less sclerotized than terga or almost membranous, in few species more sclerotized than terga. S8 undifferentiated from other sterna.

Male genitalia (Figs. 230-231). Tegumen vaulted, in dorsal aspect conical or subconical in outline, slightly asymmetrical (Fig. 230); anterior edge narrowly V-emarginate, emargination shorter than half of medial length of tegumen; in lateral aspect (Fig. 231), anterior edge broadly rounded, dorsal surface somewhat flattened or concave, posteriorly slanted; ventral edge broadly inflexed, tegumen thus partly closed ventrally; posterior edge dorso-medially somewhat indistinct, laterally invaginated into slightly recessed concavities mediad of pedunculi; pedunculi differentiated in ventral aspect by marked sinuation or constriction of postero-ventral edges of tegumen, articulated with base of valvae. Uncus fused to postero-medial edge of tegumen, shorter than and indistinctly differentiated from the latter, medial or slightly skewed rightward, conical, dentiform or lobate, asymmetrical, sublobate on left side, basally with patch of very short setae (Figs. 230-231); in some species base distinguished from posterior edge of tegumen by somewhat indistinct translucent gap. Gnathos strikingly asymmetrical, relatively large, prominent, fused to posterior edge of tegumen; paired proximal arms slanted in antero-posterior oblique plane, differently developed; right proximal arm basally lobate or very thickly and darkly sclerotized with pointed or digitate process directed caudally (Fig. 231); left proximal arm with entire length fused along left latero-posterior edge of tegumen, more developed than right arm, with large, prominent, distally protruded, markedly sclerotized and darkly melanized lobe (lobe black even after KOH treatment) with coarsely pointed, in some species almost spinose (Figs. 89-90), surface with scabrous microsculpture, lobe digitate or with anteriorly recurved point (Fig. 231); single distal arm simple, attenuate, sigmoid, somewhat asymmetrically bent, pointed posteriorly or ventrally (Fig. 230), apical portion heavily sclerotized and black in some species. Vinculum shaped as transverse, semi-circular plate fused to ventral wall of base of valvae, slightly asymmetrical, portion laterad of base of valvae rounded and winglet-like (Fig. 231). Valvae with bases broadly fused together and with vinculum into concave plate with latero-dorsal lobate angles recessed beneath posterior edge of tegumen and articulated into sockets formed by concavities of postero-ventral edge of tegumen; valvae symmetrical or subsymmetrical, simple, unarmed, blade-like or distally spatulate, dorsal surface densely setose in distal half (Figs. 230-231). Diaphragma absent, space filled by ventral concavities of posterior edge of tegumen and by plate of vinculum and base of valvae which articulates into concavities of tegumen. Juxta absent. Aedeagus tubular, basally slightly swollen, distally attenuate, ankylosed between latero-dorsaal lobes of plate formed by vinculum-valvae, bent rightward from point of articulation, apex situated above costa of right valva (Figs. 89, 231); phallotreme apical; bulbus ejaculatorius smaller than tegumen, semi-elliptic in outline, flattened (Fig. 230).

Female abdomen. Segments 1-6 as in males; in some species venulae of S2 double. T7 elongate-rectangular. S7 elongate-rectangular, subtrapezoid or conical, posterior margin in some species with markedly sclerotized inner fold or flap; in some species S7 lightly sclerotized, medially divided by membranous longitudinal band.

Female genitalia (Figs. 331, 386). T8 membranous except for narrow band along anterior edge; membranous surface with fine longitudinal striulae and with transverse row of very short and fine setae near posterior margin. S8 (Fig. 331) mostly membranous with very fine, indistinct longitudinal striulae, in some species with few very short setae; with two lightly sclerotized, in some species very diffuse and indistinct, asymmetrically shaped small sclerites, right sclerite triangular, subtriangular or irregularly shaped, with diffuse or jagged edges, in some species surface longitudinally wrinkled or ridges, left sclerite narrowly elongate, ± L-shaped or caneshaped; membrane of distal half with extremely fine microsculpture (scabrous in appearance at lower magnification). Ostium very small, in anterior third or quarter of S8 on left side in curved anterior part of left, cane-like sclerite. Ductus bursae (Fig. 386) very fine, membranous, inception laterally in posterior third of bursa or on ductus seminalis. Corpus bursae (Fig. 386) relatively small and ovoid, or large, elongate and maggot-like, posteriorly gradually narrowed into ductus seminalis; signum absent. Spermatheca (examined in only one undescribed species) elongate, sausage-like, anteriorly finely tapered, without dilated section; ductus spermathecae finely coiled. Anterior apophyses straight, slightly divergent, attached to antero-lateral angle and prolonged on lateral edge of T8 as margin, about 1.5x length of T8. Posterior apophyses longer and thinner than anterior apophyses, attached to sclerotized part of lateral walls of papillae anales. Ovipositor (Fig. 331) very short, about 0.15x length of T1-T7, basal section formed by intersegmental membrane between segments 8 and 9+10 with surface with scabrous appearance from dense, very fine pointed microsculpture; papillae anales parallel-sided or markedly tapered, distally pointed or subpointed, lateral walls of anterior half lightly to moderately sclerotized, posterior half of semi-rigid membrane, densely setose on all sides, apex markedly V-emarginate, dorsal and ventral surface with marked longitudinal wrinkles or striae, in some species ventral wall medially with marked longitudinal groove.

Monophyly and relationships. — Monophyly of *Areniscythris* is inferred from the apomorphic shape of the male tergum 8, which is linguiform and has anterior, tapered apodemes and a thick margin, very reduced tarsal spurs, enlarged, spiniform scales of the ventral surface of tarsomeres, and broad head scales. Life habits associated with active sand dunes probably also represent an apomorphic feature of the genus. Closest relatives of *Areniscythris* are species of the *Scythris charon* lineage, and members of both groups share derived similarities of the proximal arms of gnathos, which are characteristically lobate.

Included species and generic diversity. — The type species is the only described member of this genus. However I have examined specimens of five additional undescribed species from western North America.

Geographical distribution. — Seemingly endemic to the Nearctic region. All species represented in collections occur in southwestern Canada and western United States. Powell (1976: 335) mentioned another undescribed, related species from northern Baja California (which I have not examined) which indicates that the group is probably also represented in Mexico. I have also seen two female specimens of an undescribed species from Honduras (in CNC and INHS) which may belong to *Areniscythris* (I have not examined its genitalia). It is likely that additional collecting in unexplored sand dunes will lead to the discovery of additional species in other parts of North America.

Natural history. — Members of this genus exhibit some of the most remarkable life history features of the Nearctic Microlepidoptera. Adults and larvae appear to be obligate inhabitants of active, moving sand dunes. The very recent discovery of such remarkable insects (Powell 1976) attests to the unusual habits of these moths. The small adult moths run swiftly on the bare sand of dunes in bright sunshine. Their drab coloration blends well with color of the sand and this, coupled with their small size, makes them elusive if one does not pay particular attention. Macropterous *Areniscythris* are weak flyers but when disturbed, they can jump and flutter their wings, which causes them to be blown off the sand by the wind and drop to the surface some distance away. Often they continue rolling after drop-landing, as the wind continues to push them. Although the moths are diurnal, those of an undescribed species from the Great Sand Hills of Saskatchewan have been attracted to light traps, probably due to the disturbance caused by setting a light in the habitat (pers. obs.).

The larvae are just as remarkable as the adults in adaptations to life on active dunes. They are extraordinarily elongate and thin and live in sand-covered silken tubes attached to buried green parts of foodplants. They are so highly modified in body form and activity that their lepidopteran nature was not recognized when first collected (Powell 1976). The structure, life history and behavior of *A. brachypteris* have been described by Powell (1976). Recorded foodplants for the latter include Hydrophyllaceae, Labiatae, Leguminosae and Compositae. The polyphagous habits of larvae of *A. brachypteris* suggest that members of the genus are not host specific but rather feed on a range of suitable plants within their habitats.

4.7 *Asymmetrura* new genus

(Figs. 37-48, 65, 79, 86-88, 99-100, 120, 160-161, 233-248, 332-339, 387-390)

Type species. — *Butalis imnpositella* Zeller, 1855, by present designation. Type repository: BMNH.

Derivation of generic name. — From the Greek *asymmetros* (= without symmetry), and *oura* (f., = tail); given in reference to the highly asymmetrical male genitalia (or "tail end") of members of the genus. Gender: feminine.

Recognition. — In size and color members of *Asymmetrura* with immaculate forewings resemble closely those of species of *Rhamphura* . Most specimens with maculated forewings are distinguished by their forewing color pattern of transverse or oblique fasciae, which does not occur in any species of *Rhamphura* . Members of *Asymmetrura* are readily separable on characters of the genitalia. Males have strikingly asymmetrical genitalia (Figs. 233-248) with a pronouncedly convex, dome-like tegumen, reduced, inconspicuous uncus lobe, gnathos skewed leftward with the left proximal arm fused to the latero-caudal margin of the tegumen, with a prominent basal lobe and thick, in many species apically clavate, distal arm, and differently shaped valvae, the right valva being dilated, ridged or toothed, the left valva simple, blade-like and on a lower transverse plane than the right one. Females have a posteriorly or ventrally projected conical sterigma situated between sterna 7 and 8 (Figs. 333, 335, 337, 339), and sternum 7 with a median slit or invagination with the sides prolonged as pincer-like projections bracing or overlapping the base of sterigma (Figs. 332, 334, 336, 338).

Description. — Description of skeletal characters of head and thorax is based on examination of specimens of *A. impositella* and of two undescribed species.

Habitus. Medium or medium-small, moderately stout scythridids.

Color. Dark-colored, predominantly olive-brown or brown with moderate or pronounced metallic lustre. Forewing upper surface dark immaculate with moderate or pronounced brassy lustre (Figs. 38, 48), or with whitish or ochreous fasciae or spots, often basal third with oblique fascia and apical third with transverse fascia (Figs. 39-47), few species with plical streak (Fig. 37). Hindwing slightly paler than forewing. No marked color differences between sexes.

Head (Figs. 99-100). Face slightly wider than high, in profile evenly convex, rather narrow and ± wedge-shaped, or moderately broad. Scales as in *Scythris* . Eyes medium or small, interocular index 0.50-0.60, relatively flat or moderately convex, suboval or oval in outline, not extended below fronto-clypeal ridge. Fronto-clypeal ridge straight or moderately convex. Transfrontal sulcus distinctly marked, not impressed. Gena narrow or moderately broad. Pilifers small and barely protruded below fronto-clypeal ridge. Occipital ridge rounded, angulate, or sharply and narrowly grooved; occipital sulcus distinct or absent. Temporal sulcus distinct or indistinct, or absent. Post-occipital region in lateral aspect flat or markedly concave. Post-occipital region shallowly concave in lateral aspect. Postgena in lateral aspect narrow. Ocelli ± prominent. Haustellum very long, extended to middle or apex of abdomen. Antenna as in *Scythris* , except scape in most species without pecten, in some species with small tufted pecten of 2-3 scales near base, flagellum with 24-30 articles, cilia shorter than article width. Maxillary palpi (Figs. 99-100, d) with two, three, or four articles, small or reduced and inconspicuous. Labial palpi (Figs. 99-100, c) upcurved, LP/HH = 1.67, article 2 about 1.5x length of article 1.

Thorax. Prothorax as in *Scythris* except: pronotum with markedly developed median carina, in some species antero-ventral margin markedly sclerotized; propleuron short, with sides convex in frontal aspect, antero-dorsal apodeme narrow, or broad and flange-like; furcal process with small protuberance, without intercoxal lamella; ventral margin of sterno-pleural bridge broadly rounded, not laterally produced.

Mesothorax as in *Scythris* except: epimeron subrectangular, with trans-epimeral sulcus sharply defined, delineating internally ridged dorsal margin, connection with dorsal epimeral arm narrow; upper sector of precoxal suture indistinct (Fig. 120); margino-pleural suture extended over half width of katepisternum; pre-episternum without transluscent area (Fig. 120); secondary apophysis of lateral arm of furca simple, stubby and flange-like, or bifurcate.

Metathorax as in *Scythris* except: Metascutellum with more or less prominent anterior angles and, in some species, with postero-median, longitudinal, internal carina. Intercoxal lamella absent. Furcal apophysis low and attached medially to furcal process with anterior projections small and stubby and posterior projections rather short, less than half length of process; or apophysis attached subapically to, and projected high above, furcal process.

Legs as in *Scythris* except without additionnal pre-apical spine on tarsomeres.

Wings (Figs. 160-161). Forewing lanceolate, broadest near middle, FL/FW = 3.8-5.7, markedly broader than hindwing, FW/HW = 1.5-2.0, apex pointed or acute, termen straight, slightly or markedly sinuate, in some species markedly constricted. Hindwing narrowly lanceolate, broadest near base or in basal third, HL/HW = 4.7-7.3, apex acute, hind margin straight or slightly sinuate. Venation as in *Scythris* except as follow: forewing with Sc terminated before middle, distance R1-R2 1.8-4.0x distance R2-R3, pterostigma absent; hindwing with Sc+R1 extended to, or interrupted before, middle of costa, M1 connected to, or free from, Rs, M2 and M3 separate, CuA1 and CuA2 short, CuP absent. Retinaculum of females and frenum as in *Scythris* . Frenulum in males with one bristle, in females with two or three bristles (in few females with one bristle).

Male abdomen. T1-T2 suture singly or doubly margined, in some species with bare suggestion of doubling or distinctly double only laterally or medially, internally not expanded into ridge; sclerotized area of T1 covering posterior half of tergum. T2-T7 moderately sclerotized in most species, markedly so or nearly membranous in few species; T3-T7 anteriorly margined. T8 about as sclerotized as preceding terga, somewhat differentiated and of various shapes: elongate-subrectangular, subquadrate, transverse or subtrapezoid, with posterior margin asymmetrically emarginate, truncate or rounded, anterior margin deeply, roundly emarginate, in many species whole tergum asymmetrical or irregularly shaped with apex incised and appearing bilobate, or pointed with terminal tuft of stiff, setiform scales. S2 with anterior apodemes about 0.20x length of sternum, in several species, apodemes with base broadened, appearing triangular. S3-S7 in most species less sclerotized than terga, anteriorly unmargined. S8 transverse, in some species anteriorly margined, in several species posterior margin roundly or irregularly emarginate.

Male genitalia (Figs. 86-88, 233-248). Strikingly asymmetrical with several parts fused, markedly sclerotized and very darkly melanized, black. Tegumen dorsally convex, dome-like or vaulted (Figs. 234-235, 236-238, 240-243, 245-246), profile asymmetrical from every aspect: in dorsal aspect (Figs. 234, 238, 242, 246), subconical, suboval, subcircular, or very irregularly shaped, elongate or transverse, anterior edge rounded, entire, not emarginate; in left lateral aspect (Figs. 236, 240, 248), subtriangular, subconical, subcrescentic, semi-elliptic or semi-circular, anterior edge rounded, posterior edge dorsally rounded, in many species produced posteriorly then ventrally concave, in several species almost straight and vertical; in anterior aspect, arch-like, broadly rounded or shallowly V-emarginate, in many species ventral apex (pedunculus) of one side extended farther ventrally than that of other side; ventral edge or margin broadly, irregularly, asymmetrically inflexed. Uncus dentiform (Figs. 243, 247), unilobate or bilobate (Fig. 237), with two to five long setae, markedly sclerotized and very darkly melanized, fused medially or slightly on the right of posterior edge of tegumen and to basalmost part of proximal right arm of gnathos; in many species uncus reduced and recessed under protruded edge of tegumen and distinct only as very darkly melanized area or sublobe (*e.g. A. impositella*) indistinguishably fused to base of right proximal arm of gnathos (Fig. 243). Gnathos strikingly asymmetrical, skewed or twisted to left side of genitalia, in most species markedly developed and prominent (Figs. 86, 236-238, 240-243, 245-248); left proximal arm thick, much more developed than right arm, basal section fused and curved along left latero-posterior edge of tegumen, in some species fused section slightly or moderately recessed under edge of tegumen (Fig. 240), base dorsally protruded into large, prominent, thickly sclerotized and darkly melanized lobe, lobe projected caudally or dorso-caudally, wedge-like, blade-like (Figs. 240, 243), uni- (Fig. 236) or bilobate (Fig. 248), uni- or bidentate, or scoop-like, surface in many species with slightly raised, fishscale-like microsculpture (Fig. 87); right arm much thinner than left arm, in posterior aspect extended obliquely or transversely toward left arm (Figs. 235, 237, 241), or sinuate; in some species right arm seemingly absent or reduced to inconspicuous, membranous band; single distal arm elongate, as long as, or longer, than proximal left arm, in many species very thick, extended ventrally below ventralmost plane of valvae (Figs. 86-87, 240241, 243, 248), distal or apical portion upcurved, markedly sclerotized and melanized, dilated, scoop-shaped, club-shaped, or mushroom-shaped and variously spinose or denticulate, spines projected cephalad (Figs. 87, 243, 248); in several species (*e.g. A. matutella, A. graminivorella*) distal arm thin, transluscent, rod-like, almost straight and projected posteriorly, with smooth or very finely spinulate or rugose surface (Figs. 233-234, 236, 238); in few species, distal arm absent (Figs. 245-247). Socii absent. Vinculum fused with base of valvae, projected posteriorly beneath valvae, with lateral and posterior edges indistinct, ± gradually thinned and merged with intersegmental membrane S8-vinculum; in ventral aspect plate irregularly, transversely spatulate, mushroom-shaped (Fig. 244) or linguiform, with broad part posterior and base constricted; or vinculum semi-circular, subquadrate (Fig. 239); in many species vinculum asymmetrical, in some species (*e.g. A. graminivorella*) very reduced as narrow, inconspicuous flap (Fig. 233, 247); in lateral aspect, ventrally convex, very short or variously elongate, in some species almost as long as valvae. Valvae strikingly asymmetrical, basally fused together (Figs. 233, 239, 244, 247, 248); right valva shorter and larger than left valva, in several species in plane above (dorsad of) that of left valva (Figs. 236, 240, 248), strikingly so in some species, markedly sclerotized and darkly melanized, dilated and of various shapes (Figs. 23, 235, 239, 244, 247, 248), variously lobate or with processses and concavities, dentate or ridged, or dentiform, scoop-shaped or wedge-shaped, in some species outer side longitudinally broadly concave (*e.g. A. scintillifera*), in several species with few scattered setae on inner side; left valva more slender and, in many species, longer than right one (Figs. 239, 244), in some species about as long as right valva (*e.g. A. graminivorella*), incurved or almost straight, of various shapes, blade-like, rod-like or finger-like, distally tapered, pointed or rounded, costa in most species with sparse irregular row of setae of various length, mostly short ones, in many species base of costa roundly lobate. Juxta (?) small, narrow, sclerotized band fused to ventro-basal part of aedeagus, extended obliquely to base of vinculum-valvae near base of left or right valva (Figs. 233, 239, 244), in several species band indistinct or absent. Aedeagus small or very small, in some species almost inconspicuous among darkly melanized parts of the genitalia, tubular, distally attenuate, syringe-like (Figs. 239, 244), or stubby (Fig. 233), sides slightly and irregularly sinuate, ventrally ankylosed by juxta (?) or by semi-rigid lower diaphragma, oriented obliquely in transverse plane with apical portion abutted against or subcontiguous to, basal part of inner wall of right valva, in some species apex somewhat hidden by concavity below basal process or tooth of inner wall of right valva, or wedged between dentiform uncus and base of right valva (Figs. 235, 248); in some species apex of aedeagus directed dorsally as well as obliquely to the right; bulbus ejaculatorius large, in many species strikingly expanded and larger than entire genitalia (Figs. 233, 239, 244, 248), tubular and coiled 1-3 times (*e.g. A. impositella* , *A. scintillifera* , *A. graminivorella*), or ovoid with lateral digital process (*e.g. A. matutella*) with one side or part of one side broadly opened; in some species smaller than genitalia and subtriangular or crescentic in outline (Fig. 247).

Female abdomen. Segments 1-6 as in males. T7 unmodified, elongate-rectangular or subquadrate, about twice as broad as, and more sclerotized than, preceding terga. S7 triangular or elongate-conical, markedly sclerotized, posterior margin medially emarginate or longitudinally incised, sides of emargination or slit produced into caudally pointed, pincer-like (Figs. 332, 334, 336, 338), in some species asymmetrical, projections bracing or overlapping base of sterigma cone (the latter arising from the intersegmental membrane between S7 and S8).

Female genitalia. T8 subquadrate or elongate-rectangular, in most species anterior and lateral edge lightly or moderately sclerotized, rest of tergum membranous and longitudinally finely striate; in some species entire surface lightly or moderately sclerotized, smooth (*e.g. A. matutella*); posterior margin with irregular row or fine setae. S8 entirely membranous, surface with fine longitudinal striae, laterally with 1-2 setae (Figs. 333, 335, 337, 339). Sterigma medially on intersegmental membrane S7-S8, markedly sclerotized, conical or digitate projection with apex pointed caudally or ventro-caudally (Figs. 333, 337, 339), in few species pointed anteriorly (Fig. 335), cone symmetrical or asymmetrically twisted, or medialy bent rightward, short, broad and stubby with apex rounded, or slender with apex very finely tapered, in some species (*e.g. A impositella*) apex finely drawn out, syringe-like (Fig. 339); basal edge evenly rounded or variously emarginate, asymmetrically so in some species, in few species anterior edge ventrally produced into slender lobe; basal part of cone braced or overlapped by paired, pincer-like or lobate processes of posterior margin of S7. Ostium at apex of sterigma, minute. Ductus bursae entirely membranous, very fine, in some species (*e.g. A. matutella*) finely sinuose with rippled appearance or finely coiled (Fig. 337); inception on posterior part of bursa or on ductus seminalis proximate to posteriormost part of bursa (Figs. 387-390). Corpus bursae spherical, subspherical, ovoid or elongate (Figs. 387-390). Ductus seminalis attached to posterior part of bursa close to inception of ductus bursae (or both ducts with common entrance into bursa), much broader than ductus bursae, in some species (*e.g. A. impositella* , *A. matutella*) strikingly dilated into broad, bean-shaped or ovoid, curved or bent sac a short distance posterad of bursa, sac larger or slightly smaller than bursa, with appearance of double bursa (Figs. 388-389); in few species (*e.g. A. graminivorella*) entire ductus seminalis markedly broadened and tubular and sinuate, origin distinguished as slight constriction or tapering of posterior part of bursa (Fig. 387). Spermatheca (examined in two species) as elongate, slender sac medially bent on itself, anterior apex abruptly or gradually tapered to thin filament; ductus spermathecae uncoiled. Anterior apophyses straight, parallel or divergent, thin, somewhat longer than T8 and attached to its antero-lateral angle, in some species shortly prolonged on T8 as lateral margins. Posterior apophyses thinner than, and about 1-2x length of, anterior ones. Ovipositor rather short, about 0.2-0.3x length T1-T7; papillae anales membranous, parallel-sided or moderately tapered, markedly longitudinally striate on dorsal and ventral surface, setose on both surfaces and apically, or asetose ventrally.

Notes about uncus and juxta. — I have termed "uncus" the tooth-like, markedly sclerotized, small lobe fused to the base of the right arm of the gnathos and to the posterior edge of the tegumen (Figs. 236-238, 246-247), but this is somewhat uncertain. The lobe, which bears one or a few setae, could also be a basal process of the right proximal arm of the gnathos, just as there is such a process at the base of the left proximal arm. I have interpreted the presence of setae on the lobe as indicating that it is the uncus (Figs. 241-243), because similar long setae occur on the uncus of members of the related *Neoscythris* (*e.g. N. fissirostris* and *N. planipenella*). In the latter, the uncus is clearly present and articulated independently of the gnathos on the posterior edge of the tegumen (Figs. 249, 259-260). Hence the presence of such setae in members of *Asymmetrura* may be indicative of remnants of an uncus which has become fused to the tegumen or to the base of the right proximal arm of the gnathos. Lending indirect support to this interpretation is the fact that the occurrence of setae on parts of the gnathos is extremely rare in the Scythrididae. With so much asymmetry and fusion in the genitalia of members of *Asymmetrura* , the identity and relative positions of "normally" closely associated parts such as the uncus and gnathos become very difficult to assess.

The identity of the small flap or band which protrudes from the ventral wall of the base of the aedeagus (Figs. 233, 239, 244) and ankyloses the latter to the base of the vinculum-valvae is also uncertain. It could be a reduced juxta which is fused to the aedeagus, or a sclerotized anellus with a small ventral protrusion (manica). The extremely small size and the marked degree of sclerotization and fusion of structures around the aedeagus again makes morphological interpretations very difficult. In the description, I refer to the flap as a juxta (with a question mark) to be consistent with the term used in describing other genera that possess a similarly positioned sclerite more readily interpretable as a juxta (based on shape). Use of the term "juxta" here is thus based on convenience, not on interpreted homologies. Whether all the various structures ventrally ankylosing the aedeagus in different groups of scythridids are homologous remains an open question. As was pointed out by Klots (1970), sclerites surounding the aedeagus could be derived from the aedeagus itself, or from various parts of the diaphragma, and this may even be difficult to interpret in groups with more "typical" ditrysian genitalia.

Monophyly and relationships. — Members of *Asymmetrura* share the apomorphic feature of a female sternum 7 posteriorly emarginate or cleft and produced into pincer-like projections bracing the conical sterigma.

Included species and generic diversity. — The following species are here transferred from *Scythris* (*sensu* Hodges *et al.* 1983) to *Asymmetrura* :

Asymmetrura graminivorella (Braun 1920: 40), **new combination**; northeastern USA.

Asymmetrura impositella (Zeller 1855: 241), **new combination** and type species; southern Canada from British Columbia to Québec, and northeastern USA.

Asymmetrura matutella (Clemens 1860: 127), **new combination**; eastern USA and southeastern Canada.

Asymmetrura scintillifera (Braun 1927: 59), **new combination**; southern Canada, Colorado and New Mexico.

Asymmetrura reducta (Braun 1923a: 122), **new combination**; California.

In addition I have examined specimens of 15 undescribed species from North America and México.

Geographical distribution. — Members of this genus occur in all parts of the Nearctic region including México. Some species such as *A. impositella* , *A. matutella* and *A. scintillifera* have wide known ranges.

Natural history. — Immature stages of the few species that have been reared are undescribed. Known foodplants are various species of *Aster* , Compositae (*A. impositella*), of *Helianthus* , Compositae (*A. matutella*), *Hystrix patula* Moench and *Lolium sp.* , Graminae (*A. graminivorella*). Larvae are leaf miners and produce a blotch or irregularly elongate mine, but it is uncertain whether they are obligate miners. Adults of all species are diurnal and are frequently found on various flowers.

4.8 *Neoscythris* new genus

(Figs. 33-36, 101-102, 118-119, 130, 159, 191, 249-260, 340-343, 391-392)

Type species. — *Scythris fissirostris* Meyrick, 1928, by present designation. Type repository: BMNH.

Derivation of generic name. — From the Greek *neo* (= new) and *Scythris* (type genus of the family Scythrididae); meaning "*Scythris* of the New World", a name deemed appropriate for this group which, insofar as known, is represented only on this continent. Gender: feminine.

Recognition. — Members of *Neoscythris* are medium to very small scythridids best recognized by characters of the genitalia. In males the gnathos is markedly asymmetrical with a large basal protrusion, and a strikingly elongate distal arm which is longer than, and extends ventrad of, the valvae and is apically variously hooked or recurved (Figs. 249, 257, 259). In several species (*e.g. N. planipenella*) the distal half of the gnathos arm is bent cephalad and extends beneath the genitalia (Figs. 259-261). In females sternum 7 has a medial groove and/or shallow invagination (Figs. 340, 342).

Description. — Description of skeletal characters of head and thorax is based on examination of specimens of *N. fissirostris* and of an undescribed species.

Habitus. Very small to medium, relatively slender scythridids.

Color. Pale-colored species with ground color predominantly pale whitish or drab suffused with grey, brown or pale olive-brown, with upper surface of forewing finely dark-streaked or variously finely mottled; in some species veins appearing highlighted by whitish lining of scales; hindwing upper surface in many species as pale as or paler than forewing, in some species darker than forewing. Dark-colored species with ground color predominantly dark brown or dark olive-brown, in some forewings uniformly dark with light brassy metallic lustre, in others dull with ± distinct pale plical streak. In some pale species, sexes with pronounced color differences, females with patches of contrastingly black or dark brown scales on dorsal surface of abdomen (Fig. 36) and on undersurface of wings, males with uniformly pale-colored abdomen and undersurface of wings.

Head (Figs. 101-102). Face about as wide as high, in profile evenly convex and markedly higher than broad. Scales as in *Scythris* . Eyes very large and bulbous, interocular index 0.77-0.88, suboval in outline, ventral margin extended far below fronto-clypeal ridge. Fronto-clypeal ridge slightly convex. Transfrontal sulcus distinctly marked laterally, obsolete medially. Gena narrow, antero-ventral margin deeply concave. Pilifers prominent below fronto-clypeal ridge. Occipital ridge sharply angulate; occipital sulcus barely suggested. Post-occipital region concave in profile. Temporal sulcus absent. Postgena in lateral aspect narrow. Ocelli absent. Haustellum as in *Arotrura* . Antenna as in *Arotrura* , except scape with sparse pecten of 5-12 scales, in some species with dense pecten of 15-25 scales, flagellum short with 19-23 articles, or long with 35-47 articles. Maxillary palpi (Figs. 101-102, d) as in *Arotrura* or reduced, two-articled and inconspicuous. Labial palpi (Figs. 101-102, c) as in *Arotrura*, LP/HH = 2.25-2.32, in some species article 2 very elongate, twice length of article 1.

Thorax. Prothorax as in *Scythris* except: median carina of pronotum distinct; propleurom with sides in frontal aspect narrow or bulged at wart, antero-dorsal apodeme in some species extended beyond posterior margin of propleuron; sternum with indistinct or without median carina; furcal process without intercoxal lamella, in some species (*e.g. S. fissirostris*) latero-ventrally markedly explanate.

Mesothorax as in *Scythris* except: epimeron subrectangular, connection with dorsal arm broad, trans-epimeral sulcus incomplete, or epimeron oval, connection with dorsal arm narrow and semi-membranous, trans-epimeral sulcus complete (Fig. 130); upper sector of precoxal suture absent (Figs. 118-119); pre-episternum with very small transluscent patches (Figs. 118-119); margino-pleural suture abbreviated, or long and extended almost to lower sector of precoxal suture (Figs. 118-119); secondary apophysis of lateral arm of furca narrow and longer than wide, or short and broader than long, apically bifurcate.

Metathorax as in *Scythris* except: Metascutum with distinct lateral impression. Metascutellum with prominent anterior angles and concave lateral margins. Intercoxal lamella present, very reduced, somewhat indistinct. Epimeron with marked, complete, trans-epimeral sulcus. Furcal apophysis low, arising subapically on furcal process, anterior projections about one third or one half length of posterior ones, anteriorly curved or projected dorsally, in some apex of furcal process prominent, downcurved, beak-like in lateral aspect.

Legs as in *Scythris* except tarsomeres 1-4 without additionnal pre-apical spine and with apical spines very reduced, inconspicuous as in *Areniscythris* .

Wings (Figs. 159). Forewing lanceolate, narrow or relatively broad, broadest in middle, FL/FW = 4.3-5.3, moderately to markedly broader than hindwing, FW/HW = 1.5-1.7, apex pointed or acute, termen straight or sinuate. Hindwing narrowly lanceolate, broadest near base, HL/HW = 5.3-7.0, apex pointed or acute, termen straight. Forewing with 9 10, or12 veins; Sc terminated before middle of costa; R1 as in *Scythris* or absent; other radial branches as in *Scythris* ; M1 and M2 present or absent; M3 and CuA1 connate, developed or obsolete, forked with M2 when latter present, forked with CuA2 when M2 absent; CuP developed, shorter or longer than CuA2, or very reduced and indistinct; 1A+2A as in *Scythris* ; cell closed or open; in some species, with pterostigma between apex or Sc and R2 (Fig. 159), pterostigma indistinct in some species. Hindwing with seven or eight veins; Sc+R1 extended to or beyond middle of costa but terminated before base of M1 , M1 parallel to Rs in most species or forked from apical sector of Rs in some species with Rs to costa and M1 to hind margin; M2 separate and free, or forked with M3, or M2 and M3 connate; CuA1 and CuA2 short; CuP absent; 1A+2A as in *Scythris* ; cell open or closed. Retinaculum of females and frenum as in *Scythris* . Frenulum in males with one bristle, in females with two bristles.

Male abdomen. T1-T2 suture singly or doubly margined, some species with single margin medially with short fold anterior to T2 margin; in several species with suture doubly margined, T2 margin medially sinuate, in some species internally produced into ridge. T2-T7 in many species lightly or moderately sclerotized, in few species darkly melanized, with distinct anterior margin; in several species entirely membranous and indistinct from intersegmental membranes, without distinct anterior margin. T8 in few species little differentiated, conical and moderately sclerotized or reduced and membranous; in many species markedly to strikingly differentiated, most sclerotized of terga, extended above genitalia, quadrate (Fig. 253), elongate-rectangular (Fig. 191) or conical (Fig. 255), or transversely crescentic, with variously developed antero-lateral apodemes extended into abdomen (Fig. 253) or anteriorly roundly emarginate and of bilobate appearance, distal portion deeply emarginate, bilobate or furcate, in several species whole tergum strikingly asymmetrical with very deep notch or emargination in right side, in many species apex with tufts, clusters or "brushes" of setiform or spiniform, non-deciduous scales (Fig. 191) or with row of short pegs (Fig. 255). S2 with rather short apodemes about 0.10-0.20x length of sternum, in some species apodemes markedly sclerotized and rod-like, in few species slightly sclerotized and broad, subtriangular; venulae absent, or present and longer than apodemes, about 0.30x length of sternum, in some species venulae as ill-defined, sclerotized bands; surface of anterior half of S2 in many species with medial, longitudinal hump, surface shallowly concave on each side of hump. S3-S7 similarly sclerotized to corresponding terga, undifferentiated, anteriorly unmargined. S8 differentiated from preceding sterna, in many species as strikingly so or more so than T8: elongate-conical, linguiform, subquadrate or transverse (Fig. 256), in some species asymmetrically so, with anterior margin roundly emarginate and/or with antero-lateral angles produced into apodemes extended into abdomen; (Fig. 254) in many species S8 divided into two variously developed halves, from simple, transverse, oval lobes to elaborate, elongate, markedly sclerotized, valva-like plates hinged antero-medially to each other, extended beneath genitalia (Fig. 191); in some species with such modified S8, S7 also divided into two halves by V-emargination of posterior margin, with antero-medial hinge of S8 fitted into emargination.

Male genitalia (Figs. 249-252, 257-258, 259-262). Proportionally small in relation to abdomen, subsymmetrical or variously asymmetrical, very compact (Figs. 259-262) or laterally compressed (Figs. 252, 258), with fused parts. Tegumen in most species variously asymmetrical, strikingly so in some species with one side broader or situated more anteriorly than the other and giving the impression of being deformed or twisted (Fig. 262), in few species (*e.g. N. fissirostris*) symmetrical or subsymmetrical (Figs. 249-251); in most species, anterior edge variously emarginate, emargination broad and shallow, or narrow, deep and dividing tegumen into two halves joined posteriorly by narrow transverse band (Fig. 251); in species with shallow emargination, tegumen short, transverse, ± dome-shaped (Fig. 262); in species with deep emargination, tegumen elongate in dorsal aspect (Fig. 251), in lateral aspect halves broad, semicircular, oval or elliptic in outline (Figs. 249, 257), in some species halves reduced in area and of irregular shape; in several species tegumen in lateral aspect with tilted appearance in relation to horizontal plane of valvae; anterior edge narrowly or rather broadly inflexed, in one undescribed species ventrally fused together and to base of vinculum-valvae; pedunculi variously developed, in many species with asymmetrical halves of tegumen, pedunculus of one side developed, elongate, that of other side not conspicuously developed. Intersegmental membrane T8-tegumen sclerotized in some species, as irregularly shaped or linguiform flap extended above and fused to anterior edge of tegumen. Uncus large, extended caudally or protruded dorso-caudally (Figs. 249, 257, 259), in several species longer than tegumen, markedly sclerotized, in many species distal portion darkly melanized or black; variously shaped: dentiform, hood-like, conical, digitate and lobate (Fig. 249), semi-cylindrical (Fig. 257), apically bifid, bifurcate or bilobate, asymmetrical in several species, laterally and/or ventrally variously setose, in most species medially or submedially articulated to posterior edge of tegumen, in few species fused to posterior edge of tegumen (fusion line distinct) (Figs. 259, 262). Gnathos prominent, variously asymmetrical, distal arm strikingly elongate, as long as or longer than entire genitalia (Figs. 249, 257, 259); paired proximal arms relatively wide, subsymmetrical, fused indistinguishably to latero-posterior edge of tegumen (Figs. 252, 257, 261), in some species line of fusion distinct; arms attached submedially, in posterior aspect left arm outwardly convex, right arm outwardly concave so that gnathos appears somewhat asymmetrically skewed leftward (Figs. 252, 261); junction of proximal arms (or where joined to form single distal arm) produced into large, prominent, caudally pointed, markedly sclerotized and darkly melanized process, process variously shaped, blade-like (Figs. 257-258), uni- or bidigitate, lobate, wedge-shaped (Fig. 249), plow-like, elongate or short and stubby (Figs. 259-260), surface with fishscale-like microsculpture, the latter coarse, of scabrous aspect in several species; single distal arm extremely elongate, as long as or longer than genitalia, flattened, straight, sinuate or slightly curved, variously bent, apically hook-shaped, extended posteriorly beyond apex of genitalia, or bent ventrally, ventro-anteriorly or ventro-posteriorly and extended far below ventral plane of genitalia (*e.g. N. fissirostris*) (Fig. 249) or cephalad beneath genitalia and beyond anteriormost edge of tegumen (*e.g. N. confinis*) (Fig. 257), or basal portion projected caudally, submedially abruptly bent at right or acute angle with distal half or two-thirds projected cephalad beneath genitalia and beyond anteriormost edge of tegumen (*e.g. N. planipenella*) (Figs. 259-260). Vinculum variously reduced, fused indistinguishably with base of valvae, free edge (morphologically anterior but topographically posterior) projected posteriorly beneath genitalia (Fig. 250); asymmetrical, linguiform (Figs. 257-258), or dorsally concave and trough-like, or very narrow and transverse, or as irregularly shaped plate or flap (Figs. 259-260), extremely reduced and indistinct in species with very small valvae; in several species edges of vinculum ill-defined, ± gradually merged in with intersegmental membrane connecting genitalia to S8. Valvae symmetrical (Figs. 250, 258) or variously asymmetrical (Figs. 259-261), proportionally small, bases indistinguishably fused together and to vinculum into relatively broad, transverse, concave or convex plate; in species with gnathos extended caudally or ventro-caudally, or anteriorly but without abrupt bend, valvae as slender, symmetrical or slightly asymmetrical, ± straight and parallel, tapered rods or blades parallel, tapered rods or blades (Figs. 249-250, 257-258), distal half with long, fine setae, in few species distally broadened, spatulate, or one valva with long digitate dorsal projection; in some such species, valvae extremely reduced to minute, insoncpicuous conical stubs; in species with gnathos submedially abruptly bent cephalad beneath genitalia, valvae markedly asymmetrical, short, heavy or stubby, right valva variously lobate or with dorsal projections or dentiform process, left valva simple, blade-like or curved and pointed, distal half of both valvae with long setae (Figs. 259-261). Juxta (?) somewhat as in *Asymmetrura* , as small sclerotized flange or lobate process extended ventrally from base or middle of aedeagus and attached to base of right valva (Figs. 259; in few species flange absent or membranous. Aedeagus various: very small or minute (Fig. 257), inconspicuous, or moderately large (Figs. 249, 259), in one undescribed species very large with apical portion spinose; ankylosed ventrally by flange of juxta (?), oriented obliquely across transverse plane of genitalia with apex situated on right side, wedged between concavity of right proximal arm of gnathos and base of inner side of right valva (Figs. 249, 252, 258, 262); in most species tubular and distally tapered, in several species tapered portion very slender, subacuminate, aedeagus syringe-like, with phallotreme apical (Figs. 249, 257); in many species distal half markedly curved or bent rightward at right angle from basal half (Figs. 249, 251); in some species distal portion of aedeagus dilated and bulbous, with pre-apical, small, curved, secondary tube arising dorsally or laterally, phallotreme at apex of secondary tube (*e.g. N. planipenella*) (Figs. 259, 262); bulbus ejaculatorius moderately developed, in most species smaller than tegumen, semi-oval, subcrescentic or subtriangular in outline (Figs. 250-251), in few species larger than tegumen (Fig. 257).

Female abdomen. Segments 1-6 as in males, except in most species less sclerotized than in males. S2 venulae, when present, shorter than apodemes. T7 quadrate or elongate-rectangular, in some species with medial longitudinal membranous crease. S7 elongate-trapezoid (Fig. 340) or ellipsoid, broadly conical (Fig. 342), or subquadrate with rounded angles, in several species surface postero-medially with oval or conical, transluscent, shallow invagination (Figs. 340, 342), in some species surface with longitudinal membranous crease extended from posterior margin to oval invagination (Figs. 340, 342); posterior margin rounded, straight, narrowly emarginate with paired tufts of spiniform scales (Fig. 342), or medially produced into bifid or jagged protrusion.

Female genitalia (studied in eight species). T8 with anterior margin narrowly, moderately sclerotized, lateral portions lightly or indistinctly sclerotized, medial area membranous, with fine longitudinal striae, posterior or latero-posterior area or margin with sparse, fine setae. S8: in species with ostium situated at apex of sterigma arising on intersegmental surface S7-S8, sternal surface entirely membranous or with narrow, longitudinal, lightly sclerotized band, and with fine longitudinal wrinkles or striae (Fig. 343), and/or surface finely granular from pointed microsculpture; in species with ostium on S8, sternal surface moderately sclerotized, various: slightly, evenly convex with short, truncate, medio-posteriorly protruded and markedly sclerotized cone as sterigma, postero-lateral parts lobate, produced on each side of sterigma and with some fine setae, ostium medial at apex of sterigma and off sternal surface (*e.g. N. fissirostris*) (Fig. 341); or surface irregularly sculptured, uneven, ridged on one side and with concavity on opposite side of or adjacent to ridge, or with asymmetrical, slightly protruded lobes, posterior edge with lateral cluster of fine setae, ostium minute, situated on left side of S8 and on sternal surface. In species with membranous S8, sterigma developed as markedly sclerotized, variously elongate, symmetrical or asymmetrical cone on intersegmental membrane S7-S8: cone very long and gradually finely tapered to very narrow tube, as long as or longer than S8, with oblique or longitudinal, fine ridges or striae and with very small ostium (*e.g. N. confinis*) (Fig. 343); or short, stubby, truncate, with relatively broad ostium; or ± syringe-like, with broad basal two-thirds and abruptly very finely tapered, subacuminate, distal third, asymmetrical and obliquely oriented with base situated on left side and apex pointed rightward, with extremely small ostium. Ductus bursae very fine, entirely membranous or with very short sclerotized portion inside cone of sterigma, inception in most species latero-medially on left side of bursa (Figs. 391-392), in one undescribed species inception at anterior end of bursa. Corpus bursae (Figs. 391-392) elongate-ovoid, anterior part broader, rounded, posterior part constricted and continued into ductus seminalis, in undescribed species with ductus bursae entering at anterior end, bursa very slender-ovoid with anterior part conical. Spermatheca (examined in three species) as elongate, slender sac anteriorly bent on itself, with anterior apex tapered into thin filament, ductus spermathecae with distal (posterior) half finely coiled, coils gradually wider anteriorly, in *N. fissirostris* 1-2 anteriormost coils markedly broader and lightly sclerotized. Anterior apophyses parallel or divergent, straight or slightly incurved, thin in most species, relatively thick in one undescribed species, arising from antero-lateral angle of T8, about 1.0-2.0x length of T8. Posterior apophyses very thin, in most species 1.5-2.0x length of anterior ones, in some species very long and about 3.0x length of anterior ones; in several species insertion on small, somewhat diffuse, sclerotized area of wall of papillae anales. Ovipositor relatively short, about 0.25-0.35x length of T1-T7, or appearing relatively long in species with membranous S8 and sterigma on intersegmental membrane S7-S8, segment 8 and ovipositor combined about 0.5-0.7 length of T1-T7; papillae anales membranous, tapered or parallel-sided, longitudinally finely striate, dorsal surface with sparse, short, very fine setae.

Monophyly and relationships. — Monophyly of *Neoscythris* is inferred from the presence, in males, of a markedly elongate and apically hooked distal arm of gnathos which is extended below the ventralmost plane of the genitalia. *Neoscythris* is related to *Asymmetrura* and *Areniscythris* based on aspect of the left proximal arm of gnathos, which is fused to the left latero-posterior margin of the tegumen and caudally produced into a lobe.

Included species and generic diversity. — The following species are here transferred from *Scythris* (*sensu* Hodges *et al.* 1983) to *Neoscythris* :

Neoscythris confinis (Braun, 1920: 40), **new combination**; California.

Neoscythris fissirostris (Meyrick, 1928: 413), **new combination and type species**; southwestern USA.

Neoscythris planipenella **(Chambers, 1875: 10), new combination; Texas.**

In addition I have examined specimens of 20 undescribed species from North America and Mexico.

Geographical distribution. — Known only from the Nearctic region where species occur in southern United States and northern México. All species are in arid parts of North America except perhaps *S. confinis* which ranges into northern California.

Natural history. — Immature stages and foodplants are unknown. Adults of some species are nocturnal (*e.g. N. fissirostris*), but those of several others (*e.g. N. confinis*)have been collected at various composite flowers during day time.

4.9 *Colinita* Busck

(Figs. 52, 104, 121, 131-132, 137, 171, 264-267, 344-346, 393)

Colinita Busck, 1907: 139. **Status re-established.**

Type species. — *Colinita sponsella* Busck, 1907. Fixed by Busck (*loc. cit.*) by original designation and monotypy. Type repository: USNM.

Derivation of generic name. — Probably derived from *colinus* , a New Latin term derived from aboriginal American and meaning partridge, and *-ita* (Spanish diminutive meaning little). The reason for Busck's choice of this name is unknown. Gender: feminine.

Recognition. — In color, pattern and size specimens of *Colinita* resemble those of some species of *Commodes* , *Mimiella* and *Serangites* in having a forewing pattern of fine, somewhat indistinct longitudinal dark lines over a white ground color, with, in the basal third, an obliquely transverse, somewhat zigzagged fascia preceded by a more or less immaculate pale medial area (Fig. 52). In *Colinita* however, the oblique fascia is rather well delineated whereas it is diffuse or somewhat indistinct in many members of the other genera mentioned above. Specimens of *Colinita* are best and readily separated from those of all other similarly colored species by features of male and female genitalia. In males tergum 8 has a long, narrowly digitate and slightly sinuate half, the socii are short and slightly incurved, the aedeagus is distally sigmoid and the valvae are simple rods with asymmetrical apices, the left one being bifurcate (Figs. 264-267). In females sternum 7 is a large, elongate, linguiform plate which covers the recessed ostium (Fig. 345).

Description. — Habitus. Large, rather stout scythridids.

Color. Ground color white, dorsal surface densely suffused with dark gray or olive-brown. Upper surface of forewing with dark pattern of dense suffusion and indistinct fine longitudinal lines with an obliquely transverse , somewhat zigzagged fascia in basal third.

Hindwing unicolorous, paler than forewing. Abdomen with ventral surface densely dark-suffused; in males terga uniformly whitish, in females ochreous.

Head (Fig. 104). Face as wide as high, in profile about as wide as high and evenly convex. Scales as in *Scythris* . Eyes very large, interocular index 0.81, bulbous, suborbicular in outline, slightly or moderately extended below fronto-clypeal ridge. Fronto-clypeal ridge convex. Transfrontal sulcus distinctly marked, indistinctly impressed. Gena very broad. Pilifers prominent below fronto-clypeal ridge. Occipital ridge angulate; occipital sulcus absent. Post-occipital region concave in profile. Temporal sulcus distinct. Postgena in lateral aspect narrow. Ocelli absent. Haustellum as in *Arotrura* . Antenna as in *Arotrura*, except flagellum with 47-51 articles. Maxillary palpi (Fig. 104, d) as in *Arotrura* . Labial palpi (Fig. 104, c) as in *Arotrura*, LP/HH = 1.82.

Thorax. Prothorax as in *Scythris* except: pronotum with antero-ventral markedly thickened; pre-episternum with triangular "fenestra" (zone of less sclerotization) in elbow; sternum with indistinct carina; furcal process with intercoxal lamella developed, crested; ventro-lateral margin of sterno-pleural bridge broadly and regurlarly rounded; furcal apophysis long (Fig.).

Mesothorax as in *Scythris* except: epimeron with incomplete, somewhat indistinct trans-epimeral sulcus, connection with dorsal arm broad (Fig. 131); upper sector of precoxal suture present, somewhat obsolete; lower sector of precoxal suture curved mediad, surrounded by narrow transluscent zone; margino-pleural suture abbreviated (Fig. 121).

Metathorax (Fig. 132) as in *Scythris* except: metascutum with shallow lateral impression. Metascutellum rectangular, with straight margins. Furcal apophysis low, attached subapically to furcal process, anterior projections about one third length of posterior projections and extended antero-dorsally.

Legs as in *Scythris* except without additionnal pre-apical spine on tarsomeres.

Wings. Forewing lanceolate, broadest in middle, FL/FW = 4.5-4.6, slightly broader than hindwing, FW/HW = 1.1-1.2, apex acute, termen slightly sinuate. Hindwing lanceolate, broadest in basal third, HL/HW = 3.9-4.1, costa distinctly bulged in basal third, termen straight or indistinctly sinuate. Forewing with 12 veins; Sc terminated before middle of costa; R1 attached slightly beyond middle of radius, closer to R2 than to base of Rs, distance R1-R2 about 4x distance R2-R3; R4 and R5 stalked, R4 to costa, R5 to termen; medial branches distinct to margin, M2, M3 and CuA1 on common stalk, M3 and CuA1 stalked again so system double-stalked, common stalk and CuA1 somewhat obsolete; CuP well developed at hind margin, short, subequal to, or shorter than, CuA2; fold proximate to cubitus from base of wing to middle of cell; 1A+2A forked basally, 1A obsolete but distinct on dry, descaled wing; cell closed; pterostigma absent. Hindwing with 8 veins; Sc+R1 subparallel to Rs and extended to costa beyond middle of wing and Rs-M1 cross-vein; Rs slightly curved beyond Rs-M1 cross-vein, separate from M1, origin of M1 shortly beyond middle of Rs, connected to Rs by short, oblique cross-vein and subparallel to distal sector of Rs; M2 and M3 stlaked, stalk as long as M2, base of M2-M3 in line with base of CuA1; CuP as very short, indistinct trace at hind margin; 1A+2A basally forked, obsolete but distinctly convex; cell closed. Retinaculum of females as in *Scythris* . Frenulum in males with one bristle, in females with two very closely appressed bristles (almost appearing as single bristle) or, in some specimens, with one bristle. Frenum absent.

Male abdomen. T1-T2 suture doubly margined and with short medial fold between margins. T1 devoid of scales, in very few specimens with few scattered scales. T1-T7 nearly membranous, anteriorly margined. T8 (Figs. 266-267) strikingly enlarged and differentiated, firmly joined (but not completely fused) to intersegmental membrane T8-tegumen: elongate, about length of T5-T7 combined, markedly sclerotized, medial portion ridged and with lateral pointed protrusions, distal portion long, digitiform, slightly sinuate, extended above genitalia; anterior portion of tergum deeply V-emarginate with antero-lateral angles extended internally as elongate, broad lobes; pleural lobes very large, prominent, extended to about half of digitate projection of

T8. Intersegmental membrane T8-tegumen (Fig. 266) sclerotized, rigid, hood-like, about 0.30x length of genitalia and covering socii and gnathos, fused to anterior margins of tegumen and to ventro-medial portion of T8. S2 (Fig. 171) with well developed, widely separated, short apodemes about 0.10x length of sternum; venulae obsolete as somewhat indistinct, sclerotized bands longer than apodemes and delineating medial, slightly elevated, unscaled area; sternal surface with . S3-S8 thinly to moderately sclerotized, transversely rectangular, unmodified, without anterior margin; S6-S7 medially membranous, appearing divided into two sternites. S8 very small, about 0.25 size of, and surrounded anteriorly and laterally by, S7.

Male genitalia (Figs. 264-265, 267). Proportionally large in relation to abdomen, somewhat asymmetrical. Tegumen short, divided into two halves by deep and broad anterior emargination, halves dorso-medially joined by narrow margin (Fig. 264) and in form of low, posteriorly slanted arch above base of ventral part of genitalia (Fig. 267); each half oval-triangular in lateral aspect, small in area, width about 0.10x length of whole genitalia, entire perimeter with pronounced, rather wide margin. Base of 10th segment (socii-gnathos) with small patches of rugulose cuticle. Uncus absent. Socii as rather short, incurved in dorsal aspect, sparsely and finely setose, digitate processes about 0.20x length of genitalia. Gnathos wishbone-shaped (Fig. 267), paired proximal arms thicker than distal arm, arising contiguously with and fused to base of socii, distal arm thin, asymmetrically curved rightward, apically hook-like and subacuminate. Vinculum (Figs. 265, 267) transverse, flap-like, projected caudally beneath base of valvae, posterior margin rounded, about 0.30x length of genitalia, anterior margin medially produced cephalad into broad triangle. Valvae elongate, rod-like, distally asymmetrical, ventral margin basally fused to antero-medial triangular process of vinculum costa with row of sparse, fine setae, base emarginate to about 0.20-0.25x length of valvae; right valva simple, distally tapered and slightly upcurved; left valva slightly longer than right valva, distal third with rounded protuberance on costa, apical portion narrowly tapered. Diaphragma entirely membranous. Juxta (Fig. 265) very short, transverse, vertical, rudder-shaped sclerite with base articulated to anterior margin of triangular projection of vinculum, and apex fused to ventro-subbasal part of aedeagus. Aedeagus ankylosed by juxta, base protruded cephalad of anterior margin of vinculum and tegumen; tubular in shape, about 0.30x length of genitalia, in lateral aspect base moderately dilated with rounded dorsal crest, distal third abruptly ventrally bent and sigmoid, phallotreme oriented ventrally. Bulbus ejaculatorius as small, subcrescentic, membranous flap.

Female abdomen. T1-T2 structure as in males except without intercalated medial fold between margins, T2 margin medially internally produced into narrow flap. T1 scalation as in males. Terga and sterna 1-5 lightly sclerotized, margined as in males. T3-T4 with anterior portion invaginated into broad fold. T5 medially with narrow, longitudinal, membranous groove. S2 apodemes more proximate than in males, separated by gap about equal to their length, attached to unscaled anterior plate, plate distinctly separated from posterior, less sclerotized portion of S2. Segments 6-7 markedly sclerotized and differentiated from preceding segments (Fig. 344): T6 transversely subrectangular, medially with fine, oblique wrinkles, anterior margin extended laterally and ventrally onto anterior portion of S6 as narrow laminae, fused as transverse ridge on S6. S6 subquadrangular. T7 elongate-rectangular, with anterior margin extended as laminae laterally like margin of T6, ventrally abutted, though not fused, to antero-lateral angles of S7. S7 part of genitalia (described below).

Female genitalia (Figs. 345-346). S7 large, elongate-linguiform, apical third projected above basal portion of S8, markedly thickened, posterior margin rounded with small, protruded, medial membranous lobe. T8 elongate, about half length of T7, caudal half bilobate, lightly sclerotized, with few sparse, fine setae. S8 transverse, about half length of T8, very slightly sclerotized, medially membranous, posterior margin with few sparse, fine setae. Sterigma ring-shaped, at anterior end of intersegmental membrane S7-S8 and covered by distal, protruded portion of S7. Ostium small, in middle of sterigma, oriented dorsally. Ductus bursae (Fig. 393) fine, membranous, ribbon-like, inception at one apex of bursa. Corpus bursae (Fig. 393) extremely large, almost filling entire abdominal cavity when inflated, very elongate, sausage-like and submedially U-bent into two unequal portions, longer portion broader, medially dilated and apically abruptly constricted into ductus seminalis, the latter thus attached to apex of bursa opposite to that of inception of ductus bursae. Spermatheca not examined. Anterior apophyses long, thin, parallel or slightly divergent. Posterior apophyses about 1.5x length of anterior ones. Ovipositor about 0.20x length of T1-T7, with membranous papillae anales.

Note about structure of female genitalia. — Topography of the sterigma, ostium and sterna 7 and 8 of the female genitalia is confusing. The caudal part of S7 is projected caudally and overlaps the anterior part of S8 (Fig. 346). The intersegmental membrane between S7 and S8 is thus folded on itself beneath the protruded portion of S7 and its anterior end is tightly wrinkled immediately cephalad of the sterigma. In ventral aspect (Fig. 345), the ring-like sterigma and the ostium appear to be part of S7, but actually are situated on the intersegmental membrane S7-S8 and sandwiched between S8 and the projected distal portion of S7, with the ostium facing dorsad toward the surface of S8. Their position must be assessed by rotation of the genital segments and is best revealed by examination in lateral oblique view.

Monophyly and relationships. — Monophyly is inferred from the simple, rod-like valvae of male genitalia, a state that possibly represents a secondary reduction, and shape of S7, in form of a large, linguiform plate which encloses the sterigma and ring-like ostium. Members of *Colinita* and of other genera treated below all belong to the so-called *Arotrura* complex (see Chapter 5), whose members are characterized by lack of frenum (plesiomorphic feature), enlarged male tergum 8, sclerotized intersegmental membrane T8-tegumen, elongate and markedly sclerotized socii, and presence of a membranous lobe on the posterior edge of sternum 7 of females (apomorphic features).

Included species and generic diversity. — The type species is the only known member of this genus. I have seen no undescribed species in collections that might be congeneric.

Geographical distribution. — Endemic to the Nearctic region, and apparently restricted to the deserts of southwestern United States and Baja California (México) (Fig. 412).

Natural history. —Immature stages and foodplants are unknown. Adults are nocturnal.

4.10 *Hyalinixys* new genus

(Figs. 61, 268-271, 347-350, 394)

Type species. — *Hyalinixys sinuosa* new species, by present designation. Type repository: UCB.

Derivation of generic name. — From the Greek *hyalinos* (= transparent) and *ixys* (f., = waist); given in reference to the membranous lateral portions of the tegumen of male specimens. Gender: feminine.

Recognition. — In color, pattern and size, members of *Hyalinixys* resemble specimens of species of *Commodes* , *Mimiella* and *Serangites* but are recognized externally by the row of alternating dark and pale dots along the margin of the apical portion of the forewings (Fig. 61). They are however more certainly distinguished from them and from all other scythridids by features of the genitalia. In males the tegumen has membranous lateral walls with only a narrow, C-shaped sclerotized anterior band, the socii are very short and outcurved and the aedeagus is strikingly sigmoid (Figs. 268-270). In females sternum 6 is very narrowly transverse, almost fused to sternum 7 and has latero-posterior flanges encircling sternum 7 and extended along the lateral margins of sternum 8, and the sterigma is formed by the markedly sclerotized sternum 8 which is asymmetrical and has a deep, ridged concavity within which lies the ostium (Figs. 347-348).

Description. — Skeletal traits of the head and thorax were not studied from potash-cleared specimens.

Habitus. Medium-large, moderately stout scythridids.

Color. Ground color of dorsal surface white suffused with brown or olive-brown. Ventral surface of body and entire abdomen white. Dorsal surface of forewing with dark pattern of oblique fasciae, indistinct fine streaks or suffusion, a dot in distal third, and termen and apex of costa with alternating white and dark dots (Fig. 61). Hindwing unicolorous, paler than forewing. No marked color differences between sexes (female known only for type species).

Head. Face, eye, haustellum, antenna and palpi as in *Commodes* (except relative measurements not taken).

Thorax. Skeletal characters not studied.

Wings. Forewing lanceolate, broadest in middle, FL/FW = 4.6-4.7, as broad as, or slightly broader than, hindwing, FW/HW = 1.1-1.2, apex acute, termen moderately sinuate. Hindwing lanceolate, HL/HW = 4.1-4.6, broadest in basal third, costa bulged in basal third, apex acute, termen moderately sinuate. Venation as in *Colinita* . Retinaculum as in *Scythris* . Frenulum as in *Arotrura* or in some females with one bristle. Frenum absent.

Male abdomen. T1-T2 suture doubly margined, not internally ridged, in some specimens T2 anterior margin medially sinuate. T2-T7 membranous or with indistinct, small, less sclerotized area medially, anteriorly finely margined. Anterior margin of T6-T7 in one species (*H. sinuosa*) with medial, triangular, membranous invagination extended internally as thin filament. T8 (Fig. 271) strikingly enlarged, differentiated from preceding terga, markedly sclerotized, extended above genitalia: elongate-subtriangular, each side with two ventral lobes, anterior lobe pointed and articulated to tegumen near ventral articulation with valvae, posterior lobe at about middle of tergum and rounded, distal portion of T8 digitate and asymmetrically sinuate, downcurved, surface medially with "window" of light sclerotization; antero-lateral angles produced into slender arms extended internally to middle of T6. S2 with apodemes about 0.15x length of sternum, venulae indistinctly delineated, markedly sclerotized bands, unscaled area between venulae with irregular, somewhat Y-shaped ridge. Intersegmental membrane T8-tegumen sclerotized, in form of band along posterior edge of tegumen and somewhat wider than the latter. S2-S8 medially slightly or indistinctly sclerotized, gradually smaller on distal segments. S8 reduced, membranous, indistinct.

Male genitalia (Figs. 268-270). Large relative to abdomen, appearing very open because of membranous tegumen and small socii, with some asymmetrical parts. Tegumen divided into two lateral halves, each half reduced to narrow, antero-ventrally arched band extended from dorso-medial portion of segment 10 (socii-gnathos) to base of valva, articulated to antero-ventral margin of valva, W-shaped in dorsal aspect (Fig. 269), C-shaped in lateral aspect with dorso-medial part at junction of halves elevated, crested, lateral wall membranous (Fig. 268). Base of 10th segment fused to tegumen, with small area of rugulose cuticle near fusion line; ring-shaped in dorsal aspect, in lateral aspect narrow, collar-shaped or dorsally dilated or humped. Uncus absent. Socii sclerotized, crescent-shaped and curved outwardly, sparsely setose, very short, 0.05-0.10x length of genitalia (Fig. 269). Gnathos (Fig. 269) of delicate appearance, wishbone-like, paired basal arms projected subventrally, attached near base of socii, distal arm projected caudally, about length of, or slightly shorter than, basal arms, slightly curved leftward with apex hook-like. Vinculum (Fig. 270) markedly reduced, rather inconspicuous, fused to ventral margin of base of valvae, distinguished only as narrow, transverse rim indicated by line of fusion. Valvae articulated to tegumen, medio-basally broadly fused together, fusion bridge (Fig. 270) about 0.40-0.50x length of valvae; base of ventral wall of valvae broadly and deeply emarginate to about one third length of valvae (Fig. 270); in lateral aspect (Fig. 268) valvae moderately upcurved, antero-lateral part slanted, articulation with pedunculus distant from anterior apex ; valvae asymmetrical, with sinuate outline, proximal two-thirds devoid of ornamentation, inner wall concave, cucullar lobe little developed as slight or indistinct, densely setose protuberance of costa, apex constricted or tapered (Figs. 268-269). Diaphragma membranous, without sclerotized plates and not noticeably expanded. Juxta (Figs. 268, 270) markedly sclerotized, short, in ventral aspect trapezoid, immovably fused to anterior margin of valvae and medio-ventrally to aedeagus, in lateral aspect articulation with valvae curved around valval margin, portion fused to aedeagus ±

rudder-like and prolonged as longitudinal crest along anterio-ventral part of aedeagus (Fig. 268). Aedeagus large, about 0.75x length of genitalia, markedly sclerotized, distally moderately to markedly tapered and strikingly sigmoid; basal third extended cephalad of base of valvae, with low dorsal longitudinal crest, base slightly to distinctly reflexed (Figs. 269-270); wall on each side with small lateral "window" just anterior to line of fusion of juxta. Bulbus ejaculatorius not developed.

Female abdomen. Known only for type species. T1-T2 structures as in male. T1-T4 slightly sclerotized. T5-T7 (Fig. 349) moderately sclerotized, stiff, tightly attached together by stiff intersegmental membranes; T5 transversely rectangular, broad. T6 about half size of T5, anterior margin with pair of lateral lobes recessed beneath posterior margin of T5. T7 smaller than T6, anteriorly with pair of rod-like apodemes extended under T6. S2 as in male. S2-S4 lightly sclerotized. S5-S8 firmly attached to one another as for T5-T7. S5 well sclerotized, medially divided by longitudinal, membranous groove, anterior margin invaginated and irregularly folded into wrinkled inpocketing. S6-S7 (Fig. 347) markedly sclerotized and differentiated from preceding sterna: S6 very narrow, laterally with caudally recurved, slender flanges as brace for S7. S7 (Fig. 350) firmly juxtaposed (though not quite fused) to S6 and S8, overlapping S8, narrow, anteriorly with lateral, slender, curved flanges abutted to posterior margin of preceding sternum; posterior margin with lateral angles acuminate, medially with protruded, sclerotized

Female genitalia. Same as for type species, the only member of the genus whose females are known.

Monophyly and relationships. — The membranous lateral walls of the tegumen of males and shape and fusion of sterna 6-8 of females are regarded as apomorphies supporting the monophyly of *Hyalinixys* . Relationships to other genera of the *Arotrura* complex are not elucidated, but members of *Hyalinixys* retain such plesiomorphic features as simple socii and an aedeagus ankylosed submedially.

Included species and generic diversity. — The type species is the only described member of this new genus. In addition, another undescribed species occurs in Baja California.

Geographical distribution. — Known only from southern California, Baja California and Sonora, México.

Natural history. — Immature stages and foodplants are unknown. The species inhabits arid regions and adults are nocturnal.

4.10.1 *Hyalinixys sinuosa* new species

(Figs. 61, 268-271, 347-350, 394, 417)

Type material. — HOLOTYPE, male, labelled: La Jolla, San Diego Co., California, 10.vii.1963, blacklight, J. Powell collector" [two white, printed labels] (UCB). PARATYPES, 17 males, 3 females. ALLOTYPE, female, labelled same as holotype except for date: 18.vi.1963 (UCB). Thirteen males, two females, all with same locality label as holotype, dates and collectors vary as follow (J. Powell coll. unless otherwise indicated); seven males, one female: 17.vi.1963, at blacklight, two males coll. by H.L. Griffin, one male coll. by R.L. Langston; female not labelled as having been collected at blacklight but this might be an omission; female genitalia on slide no. JFL-85-0314 and right wings on slide no. JFL-85-0429; one male, 18.vi.1963; one female, 25.vi.1963, genitalia on slide no. JFL-85-0334; two males, 1.vii.1963; three males, 22.vii.1963 (UCB). Four males: 4 mi. S El Socorro, Baja California Norte, Mexico, 25.iii.1973, J. Powell; one male genitalia on slide no. JFL-86-0519 (UCB).

Type locality. — La Jolla, San Diego Co., California.

Condition of holotype. — Spread, pinned with minuten, double-mounted on polyporous block, abdomen undissected (but detached and placed in gelatine capsule beneath the specimen). Cilia of forewings somewhat rubbed, distal third of right antenna missing; otherwise in good condition.

Derivation of specific epithet. — From the Latin *sinuosus* (= winding, full of bending); given in reference to the sigmoid male aedeagus.

Recognition. — In external appearance, specimens of *H. sinuosa* are indistinguishable from those of the other undescribed species of the genus, which probably occurs sympatrically in at least the Mexican province of Sonora. The two species, however, are easily separable on features of male genitalia (females of the undescribed species are unknown). In males of *H.*

sinuosa (Figs. 268-269, 271), the posterior left lobe of T8 slightly protruded laterally whereas the right lobe is submedial and completely beneath the tergal surface, the anterior margin of T8 is emarginate on the right side, the window is triangular and ill-defined on the right side and the apex is dilated, subspatulate; the base of the socii-gnathos is narrow in lateral aspect; the valvae, especially the left one, have a distinct, though small, cucullar protuberance and have the apical portion markedly constricted and lobate-spatulate; the aedeagus is slanted to the left with the sigmoid curve distinct in dorsal aspect, and the apical portion is regularly curved leftward with the phallotreme being apical. In the undescribed species, the posterior lobes of T8 both protrude laterally, the anterior margin of T8 is entire, the window is narrowly elongate and well defined on all sides and the apex is tapered and sinuate; the base of the socii-gnathos is markedly dorsally humped in lateral aspect; the valvae have not distinct cucullar bulge and the apical portion slightly constricted and tapered; the aedeagus is not laterally slanted, the sigmoid curve being somewhat indistinct in dorsal aspect, and the apex is abruptly curved leftward with the phallotreme distinctly pre-apical.

Description. — Size. Forewing length 6.9-8.0 mm (mean = 7.8); hindwing length 6.3-7.5 mm (mean = 7.0); wing expanse 14.8-19.3 mm (mean = 16.8) (5 specimens).

Head. Face and neck tufts white variously and evenly mixed with drab and/or pale olive-brown. Eye large, globulous, about as wide as frons, less prominent in females than in males. Haustellum base covered with white or mixture of white and drab scales. Maxillary palpi white, conspicuous. Labial palpi extended to vertex; article 1 white; articles 2 and 3 white with broad, medial or ventro-medial, olive-brown annulation, or mostly olive-brown with narrow basal and apical white annulation; in several specimens, inner and upper surfaces predominantly white. Antenna: scape dorsally colored as face, ventrally white, scales of pecten white; pedicel and flagellum dorsally olive-brown or drab.

Thorax. Dorsal surface with similar mixture of white, drab and olive-brown as that of face and with some buff or ochreous scales. Ventral surface lustrous white, except area just below base of forewing light drab. Legs: foreleg with outer surface of coxa and femur colored as face, inner surface white, outer surface of tibia and tarsus predominantly olive-brown or drab with scattered white suffusion, inner surface of tibia white, of tarsus colored as outer surface, in some specimens apex of tibia with white annulation; middle and hind leg predominantly white with various mixture of drab and olive-brown, except tarsi predominantly drab or olive-brown.

Wings (Fig. 61). Forewing upper surface with ground color white, or predominantly white, with mixture and sufusion of drab, buff and olive-brown patterned as follows: basal third with oblique, somewhat diffusely V-shaped, olive-brown fascia behind fold, in some specimens fascia expanded anteriorly to costa; submedially with iregular or V-shaped olive-brown fascia across fold, seaprated from subbasal fascia by white area or white area with some buff; apex of cell with olive-brown dot; margin of apical third or wing with series of alternating olive-brown and white dots, dots larger and more distinct along costa than termen; in several specimens disc with several indistinct buff or drab streaks along radius and medius; ventral surface ± uniformly grey-drab with apical quarter cream-color or ochreous; cilia pale drab-ochreous. Hindwing with both surfaces uniformly ochreous-drab, somewhat lustrous; cilia pale drab-ochreous.

Abdomen. In male, dorsal surface entirely lustrous snowy white or ivory-white; lateral margins of projection of T8 with elongate, hair-like scales contrasted with shorter, elongate-oval scales of middle of surface; T1 scatteringly scaled; ventral surface white or ivory-white, in most specimens medially with suffusion of pale drab. In female (only ventral surface of allotype known because this is the only undissected female available and its wings are unspread, thus hiding most of the dorsal surface of the abdomen), ventral surface with basal two-thirds white suffused with buff scales, scales short, oval or suboval, distal third pale drab or ochreous, scales long, narrow, lanceolate; dorsal surface with distal portion of T7 yellow.

Male genitalia (Figs. 268-271). T8 (Fig. 271) with anterior ventral lobes asymmetrically located, left lobe more anterior than right lobe, tergum thus appearing more deeply emarginate on left than on right side; posterior ventral lobes asymmetrical, left lobe laterally protruded beyond margin of tergum, right lobe completely situated beneath tergal surface, more medial; anterior emargination with small, rounded notch on right; apical portion of tergum somewhat dilated, subspatulate; window of tergal surface subtriangular. Base of 10th segment (socii-gnathos) not dorsally dilated, narrow in lateral aspect (Fig. 268). Valvae, especially right one, with distinct cucullar bulge, apical portion markedly constricted, lobate-spatulate. Aedeagus obliquely slanted to the left, with sigmoid curve easily distinct in dorsal aspect, apex regularly curved and tapered, phallotreme apical.

Female genitalia (Figs. 347-348). T8 well sclerotized, transversely rectangular, caudal margin lined with 10-12 long, fine setae. S8 markedly sclerotized, heavy, forming stergima: somewhat suboval, asymmetrical in outline, anterior half skewed leftward, deeply concave, with ostium situated in anteriormost part of concavity, with two sinuate ridges arising from sides of ostium, extended posteriorly, divergently on sternal surface and with dentiform lobe on each side of ostium; posterior margin sinuate, with medial notch, caudally protruded and lip-like in lateral aspect, lined with few setae on each side of notch, surface of posterior third rugulose from fine, pointed microsculpture. Ostium rather broad, rounded, situated anteriorly and on the left of S8. Ductus bursae fine, ribbon-like, membranous except near ostium where widened into markedly sclerotized, bulbous antrum separated from ostium by narrow, membranous gap; inception of ductus anteriorly on left side of bursa. Corpus bursae (Fig. 394) very large, anterior half broad and somewhat straight-sided in ventral aspect, demarcated from posterior half by marked constriction on one side, posterior half gradually tapered and indistinguishably continued into ductus seminalis and vestibulum of vagina. Spermatheca not studied. Anterior apophyses relatively short, somewhat sinuate, equal in length to S5-S8 combined, base attached at anterplateral angle of T8. Posterior apophyses thinner than, and about twice as long as, anterior ones.

Ovipositor rather short, about 0.30x length of T1-T7, membranous, papillae anales slender, parallel-sided, entirely membranous, as long as intersegmental membrane between 8th segment and themselves.

Variation. — No significant variation was noted in specimens examined.

Geographical distribution and period of flight. — Known only from the type locality and from another locality in northern Baja California (Fig. 417). Adults have been collected from mid-June to late July in southern California and in late March in northern Baja California. They are nocturnal and attracted to blacklight.

Hostplant. — Unknown.

4.11 *Meniscotus* new genus

(Figs. 59-60, 107, 122, 167, 170, 272-276, 351-352, 395)

Type species. — *Meniscotus balli* new species, by present designation. Type repository: UCB.

Derivation of generic name. — From the Greek *meniskos* (= crescent), and *-tus* (Latin suffix meaning having the nature of); given in reference to the crescent-outline tegumen (in lateral aspect) of the male genitalia and the similarly shaped sterigma of the female genitalia. Gender: masculine.

Recognition. — In external appearance and color, members of *Meniscotus* are somewhat similar to specimens of *Commodes* , *Neoscythris* , *Oncoxystus* and *Serangites* , but are on average smaller than them (except for *Neoscythris*). Externally they are distinguished from *Neoscythris* by the broader hindwings with a slight bulge in the costa and by the lack of frenum. *Meniscotus* is also readily distinguished from the other genera mentioned above by characters of the genitalia. The aedeagus of males is distally gradually tapered, has the base dorsally and laterally explanate and crested so that it appears to have winglets and looks somewhat torpedo-like (Fig. 272), and in most species has a varied number of small, rounded "windows" (appearing like small holes) around the joint with the juxta; the distal arm of the gnathos is very elongate, about twice longer than the paired proximal arms, and has an acuminate (unhooked) apex (Fig. 272); and the dorsal wall of the fused base of the valvae is medially formed into a sclerotized concavity (Figs. 272, 274). Females of *Meniscotus* are recognized by the sterigma which is funnel-shaped with a semi-elliptic or crescentic anterior band around the ostium, and the posterior angles of sternum 8 which are protruded or lobate (Fig. 352).

Description. — Description of skeletal characters of head and thorax is based on examination of specimens of an undescribed species.

Habitus. Medium or medium-large, rather slender scythridids.

Color. Predominantly pale, whitish, drab or pale grey, variously suffused or steaked with brown, olive-brown or dark grey. Upper surface of forewing in many species (*e.g. M. balli*) predominantly pale drab with broad, snowy white plical streak or with several, ± distinct, fine, longitudinal brown streaks (Figs. 59-60); in some species surface predominantly grey with white streaks. Hindwing unicolorous, paler than or as pale as forewing. Abdomen in males concolorous, in females of some species at least bicolorous (*e.g. M. balli*).

Head (Fig. 107). Head and its appendages as in *Commodes* except: interocular index 0.95; occipital ridge sharply angulate and narrowly grooved; temporal sulcus distinctly marked; antennal flagellum with 41-44 articles; LP/HH = 2.06.

Thorax. Prothorax as in *Scythris* except as follow: pronotum with antero-ventral markedly thickened, with distinct carina; sternum with indistinct carina, ventral apex sclerotized and abutted to furcal process; furcal process with intercoxal lamella crested; ventro-lateral margin of sterno-pleural bridge broadly and regularly rounded; parapatagium with three or four prominent, peg-like protuberances.

Mesothorax as in *Scythris* except: epimeron oval; upper sector of precoxal suture barely suggested; lower sector of precoxal suture very short, barely extended to level of abbreviated margino-pleural suture; pre-episternum without transluscent zone (Fig. 122).

Metathorax as in *Scythris* except: metascutum with shallow lateral impression. Metascutellum rectangular, anterior margin slightly convex, lateral margins shallowly concave, anterior angles little prominent, median carina suggested. Metepimeron with suggestion of trans-epimeral sulcus. Furcal apophysis as in *Arotrura* except with comparatively longer posterior projections.

Legs as in *Scythris* except without additionnal pre-apical spine on tarsomeres.

Wings. Forewing lanceolate, broadest in middle, FL/FW = 4.1-5.5, as broad as, or slightly broader than, hindwing, FW/HW = 1.0-1.1, apex acute, termen moderately sinuate. Hindwing lanceolate, HL/HW = 3.6-4.4, broadest in basal third, costa bulged in basal third, apex acute, termen moderately sinuate. Venation as in *Colinita* except as follow: forewing in some species with base of M1 contiguous with R4+5 and CuA1 very obsolete and indistinct, or well developed. Retinaculum as in *Scythris* . Frenulum as in *Arotrura* . Frenum absent.

Male abdomen. T1-T2 suture doubly margined (Fig. 167), T2 anterior margin medially shallowly invaginated under T1 posterior margin, in few species margins obsolete. T2-T7 membranous or lightly sclerotized, T3-T7 with fine anterior margin, in some species margin interrupted medially on T5-T6. T8 (Figs. 275-276) markedly differentiated, ventro-medially fused to sclerotized intersegmental membrane T8-tegumen, extended above genitalia, elongate, broad, with broad, oval or subquadrate antero-lateral lobes extended over lateral portions of tegumen, distal portion of tergum shallowly to deeply emarginate or bilobate, in some species asymmetrically so, in some with medio-ventral, digitate process or with paired ventral crests, or with lateral lobes and quadrilobate. Intersegmental membrane T8-tegumen (Fig. 272) sclerotized, relatively short, hood-shaped or as short dorsal flap, portion extended beyond posterior margin of tegumen about 0.15-0.25x length of genitalia, in some species covering basal half of gnathos and most of socii, in several species barely extended to base of socii and gnathos. S2 as in *Arotrura* except venulae distinct, unscaled area between venulae markedly raised, with triangular, more heavily sclerotized area. S3-S8 lightly or moderately sclerotized, unmargined. S8 small, transverse or elongate, triangular, crescentic or semicircular, about 0.50x size of S7, in some species most sclerotized of sterna.

Male genitalia. Tegumen completely divided into two broad lateral lobes by deep U- or V-shaped anterior emargination, joined dorso-medially by very narrow bridge formed by posterior margin, bridge with small caudal protrusion in most species (Fig. 273); in lateral aspect (Fig. 272) tegumen appearing slanted cephalad, entirely extended anterior to valvae, each half broadly crescentic in outline, anteriorly markedly convex or rounded with margin broadly inflexed (lobe thus having aspect of shallow bowl), posterior margin concave or sinuate; pedunculus clearly differentiated by constriction of ventral part of lobe, in some species constriction marked with pedunculus appearing upcurved, articulation on anteriormost part of valva. Base of socii and gnathos with rugulose cuticle (Fig. 273), in some species rugulose area small and indistinct. Uncus absent. Socii fused to dorso-medial bridge of tegumen, markedly sclerotized, sparsely or densely covered with short, erect setae, elongate-brachiate, about 0.15-0.30x length of genitalia, downcurved or bent down in lateral aspect (Fig. 272), parallel or with distal half divergent in dorsal aspect (Fig. 273), bases fused together or very closely contiguous. Gnathos of delicate appearance, very slender and somewhat wishbone-shaped (Fig. 272), proximal paired arms fused to medio-posterior margin of tegumen and subcontiguous with socii, in lateral aspect straight, basally curved, sigmoid or abruptly bent down, directed ventrally, in several species arms of uneven length; single distal arm basally abruptly bent at right or acute angle from proximal arms, directed caudally or dorso-caudally, very long, about twice length of proximal arms, in dorsal aspect slightly or markedly sinuate or curved laterally and asymmetrically skewed rightward, distal portion downcurved and hook-like, apex acuminate. Vinculum (Fig. 274) markedly reduced to very narrow, in many species inconspicuous, rim completely fused around anterior emargination of base of valvae. Valvae symmetrical or with asymmetrical costal lobes and apices (Figs. 272-273), basally broadly fused together, with ventral (outer) wall anteriorly deeply U-emarginate, emargination extended to third or half of length of valvae (Fig. 274); dorsal (inner) wall in form of broad fusion bridge as long as emargination of outer wall and depressed into relatively deep concavity (Fig. 274), in lateral aspect concavity bulged ventrally below ventralmost plane of valvae (Fig. 272); valvae broad in lateral aspect (Fig. 272), variously and asymmetrically bi- or trilobate, costa anteriorly emarginate with inner wall produced into anteriorly directed lobe or crest, cucullar lobe variously developed, setose, apices symmetrically or asymmetrically lobate. Diaphragma membranous, unmodified. Juxta seemingly absent or reduced and indistinguishably fused to aedeagus. Aedeagus ventrally ankylosed to anterior margin of concave part of fusion bridge of valvae by stubby, rounded lobe or transverse ridge protruded from its ventral third [possibly a manica (= sclerotized anellus)] (Figs. 272, 274), tubular, slender, more or less gradually attenuate from base to apex, variously sinuate, in some species strikingly so with distal half twisted at right angle, anterior portion (cephalad of manica) dorsally, and in several species also laterally, crested and/or with perimeter of base explanate, base thus appearing to have winglets and aedeagus having appearance of torpedo (Fig. 272); in several species zone around manica with one or few small transluscent "windows" (Fig. 272) and wall of aedeagus with areas or lines of thicker sclerotization (probably internal ridges or spines); phallotreme apical. Bulbus ejaculatorius as small semi-circular or ovoid sheath.

Female abdomen. T1-T2 suture as in male or T2 anterior margin not medially invaginated. T2-T6 slightly sclerotized, margined as in male. T7 differentiated from preceding terga, elongate-rectangular (Fig. 351), subquadrate or laterally incurved, most sclerotized of terga, in some species medial area with elongate-oval, transluscent zones (Fig. 351), anterior portion recessed under posterior portion of T6, in some species recessed portion heavily sclerotized and with pair of heavy, internal apodemes or with two zones of corrugated or wrinkled cuticle. S2-S5 as in male. S6-S7 most sclerotized of sterna. S6 unmodified or variously differentiated: medio-posteriorly with deep, markedly sclerotized fovea; or longitudinally divided by crease with pair of posterior, dentate bumps; or narrowly transverse with posterior margin deeply sinuate and produced into prominent, cordiform, markedly sclerotized lobe. S7 variously shaped, posterior margin medially with protruded, membranous lobe: trapezoid, moderately convex and very shallowly creased medio-posteriorly , or surface biconvex with deep, medio-longitudinal crease; or markedly convex, anteriorly broadly emarginate, medially with oval, transluscent zone; or, in species with cordiform process of S6, transverse, laterally markedly sinuate, antero-laterally produced into slender arms, with marked medio-longitudinal crease.

Female genitalia (Figs. 352, 395). T8 elongate-rectangular, indistincly to moderately sclerotized, in some species medially and posteriorly membranous (Fig. 352), apically with fine scattered setae. S8 with surface membranous or sclerotized, with few widely set, or many closely set, oblique wrinkles laterally in posterior two-thirds (Fig. 352) or half, latero-posterior anlges protruded, lobate, with few or many fine setae, in some species lobes sclerotized; medial surface flat or shallowly concave, rugulose from extremely fine pointed microsculpture. Sterigma on anterior margin of S8, funnel-shaped with narrow, anterior crescentic or U-shaped band with arms pointed posteriorly (Fig. 352) and finely acuminate surrounding shallow medial concavity of sternum, in some species arms lined with diffuse and lightly sclerotized, or well defined and sclerotized, bands on medial concavity. Ostium situated at anteriormost medial part of sterigma, small or moderately broad, oval. Ductus bursae (Fig. 395) slightly broadened and funnel-shaped just inside ostium then tapered, or evenly narrow throughout, or with proximal half widened, tubular with somewhat thickened wall membrane and distal half of duct fine, ribbon-like; in some species outer wall of proximal half of duct covered with extremely short villosity; inception into apex of shorter left portion of bursa. Corpus bursae elongate, sausage-like, laterally U-bent into uneven portions, shorter portion on left side and about half length of longer one (Fig. 395), in some species longer right portion medially dilated. Ductus seminalis originating at end of bursa opposite to inception of ductus bursae, as abrupt narrowing or gradual tapering of bursa. Spermatheca not studied. Anterior apophyses thin, divergent, about twice length of T8, straight or sinuate. Posterior apophyses as thin as, and slightly longer than, anterior ones. Ovipositor about 0.25-0.40x length of T1-T7; papillae anales membranous, tapered, parallel-sided or slightly dilated.

Monophyly and relationships. — Monophyly of *Meniscotus* is indicated by the elongate, slender and hook-like distal arm of the gnathos and the concavity in the dorsal wall of the fusion bridge of valvae, which is ventrally protruded below the ventral plane of the genitalia. Relationships within the *Arotrura* complex are not elucidated but members of *Meniscotus* are similar to those of *Colinita* and *Hyalinixys* in retention of plesiomorphic features of the socii and attachement of the juxta to the aedeagus.

Included species and generic diversity. — The type species is the only described member of this new genus. In addition I have seen specimens of nine other undescribed species from southwestern North America.

Geographical distribution. — Apparently restricted to the Nearctic region in the southwestern United States and northern México.

Natural history. — Immature stages and foodplants are unknown. Adults of all species are nocturnal, but some, such as adults of the type species, *M. balli*, have been collected both during day time at flowers and at blacklight during night time.

4.11.1 *Meniscotus balli* new species

(Figs. 59-60, 167, 170, 272-276, 351-352, 395, 418)

Type material. — HOLOTYPE, male, labelled: Palm Canyon, Kofa Mountains, Yuma Co., Arizona, 8.iv.1963, J. Powell collector [two white, printed labels] (UCB). PARATYPES, 44 males, 18 females. ALLOTYPE, female, labelled same as holotype (UCB). Sixteen males, two females: same data as holotype, except for collector names as follow: three males, J. Powell; nine males, two females, C.A. Toschi; four males, R.L. Langston (UCB). One male, six females: 10 mi. N Earp, San Bernardino Co., California, 22.iv.1960, J. Powell; one female with genitalia on slide no. JFL-85-0318, one female with right wings on slide no. JFL-85-0430 (UCB). Twenty-two males, eight females: Chino Canyon, near Palm Springs, Riverside Co., California, [date].iv.1960, J. Powell; dates as follow: eight males, four females, 19.iv.; fourteen males, four females, 20.iv.; three males with genitalia on slide nos. JAP 3483, JAP 3486, JAP 3496 (UCB). One male: Mazourka Canyon, 8 mi. NE Independence, Inyo Co., California, 11.v.1969, J. Powell (UCB). One male: Tuttle Creek, 2 mi. SW Lone Pine, Inyo Co., California, 15.v.1969, J. Powell (UCB). One male: Victorville, San Bernardino Co., California, 17.v.1936, C. Dammers (USNM). Two males, one female: Bishop, Inyo Co., California, 14.vi.1937, E.C. Johnston (USNM).

Type locality. — Palm Canyon, Kofa Mountains, Yuma Co., Arizona.

Condition of holotype. — Spread, pinned on minuten, double-mounted on polyporous block; cilia of right forewing damaged, otherwise in good condition.

Derivation of specific epithet. — Named in honor of my supervisor, Dr. George E. Ball, who provided penetrating guidance, outstanding support and unrelenting encouragement throughout the course of this study. The keen interest he developed about those amazing scythridid moths helped bolster my own enthusiasm and fascination.

Recognition. — Most specimens of *M. balli* are easily distinguished from those of other undescribed species of the genus by the long, snowy white plical streak of the forewings contrasting slightly or markedly with the color of the rest of the wing surface (Figs. 59-60). Specimens of some undescribed *Meniscotus* also have a suggestion of a similarly colored plical streak but these also have a small dark dot at the end of the cell and other fine, indistinct dark streaks on the disc. Other Nearctic scythridids with a white plical streak have predominantly dark, most commonly olive-brown, ground color of body and wings, in contrast to the predominantly white ground color of specimens of *M. balli* . In features of the genitalia, *M. balli* is readily separable from other undescribed members of the genus as follow: in males, T8 has the apex asymmetrically V-emarginate, somewhat fishtail-like and the ventral surface with a pair of ventrally projected, lobate crests (visible in lateral aspect) (Figs. 275-276), the socii are straight, parallel and ventrally slanted and the gnathos has a pair of small, digitate, caudally pointed lobes at the junction of the paired proximal arms (Fig. 272); in females, T7 has two well defined, elongate-oval transluscent patches (Fig. 351), S6 has a deep medio-posterior fovea, the anterior crescentic band of the sterigma is very narrow, the distal half of S8 is densely, finely wrinkled and medio-longitudinally distinctly grooved or trough-like (Fig. 352), and the ductus bursae is fine throughout and not villose.

Description. — Size. Forewing length 5.8-7.1 mm (mean 6.5); hindwing length 5.1-6.3 mm (mean 5.8); wing expanse 12.8-15.3 mm (mean 14.3) (12 specimens).

Head. Face pale ochreous-white, whitish-drab or pale ochreous-drab, with light metallic lustre, neck tufts white. Haustellum base covered with white or ochreous scales. Labial palpi with article 1 snowy white; articles 2 and 3 with dorsal surface white, ventral surface medially predominantly drab or brown mixed with some white, basally and apically white, with light metallic golden lustre. Antenna with scape, pedicel and few proximal articles of flagellum dorsally white, rest of flagellum drab or pale olive-brown with light golden metallic lustre.

Thorax. Dorsal surface ivory-white, ochreous-white or pale drab-white, except mesoscutum with lateral longitudinal snowy white stripe, with same very light metallic lustre as face. Ventral surface white, very lustrous, slightly iridescent. Legs with metallic golden lustre: foreleg with outer side slightly darker than that of mid- and hindleg, predominantly pale drab, inner side white, in some specimens with tibia and tarsus darker drab and with marked golden lustre; mid- and hindleg predominantly ochreous-white with tarsi slightly darker, pale drab.

Wings. Upper surface pale with ground color ivory-white or pale ochreous-drab, distal half variously suffused with snowy white and in some specimens with few brown scales, in some specimens snowy white scales of distal only along costa; in most specimens fold with snowy white streak extended from base to end of cell or to termen and in contrast with ivory-white or ochreous-drab ground color, many specimens with narrow, somewhat diffuse or indistinct brownish streak posteriorly lining white plical streak and extended from near base to middle or two-thirds (Fig. 59), some females with similar brownish but less distinct streak anteriorly lining plical streak; surface with same very light metallic lustre as face; ventral surface ochreous-drab or ochreous-brownish, lustre as that of upper surface; cilia ochreous-golden. Hindwing with upper surface with same but more pronounced lustre as forewing, basal half very pale ochreous-white, distal half somewhat darker, ochreous-drab; ventral surface colored as basal part of upper surface; cilia colored as those of forewing.

Abdomen. In males, dorsal surface uniformly ivory-white or ochreous-white, lustrous with light or moderate golden or iridescent hue; ventral surface colored as dorsal surface or more snowy white, with same lustre and hue; anal tufts moderately prominent, pale-ochreous. In females, dorsal suface with T1-T4 and anterior half of T5 cinnamon-brown with marked iridescent hue, posterior half of T5 and T6-T7 ochreous-white, slightly lustrous, in some specimens T5 entirely colored as T6-T7; ventral surface lustrous snowy-white except S7 ochreous-white, in some specimens lateral parts of S1-S4 grey-drab.

Male genitalia. T8 (Figs. 275-276) tightly fused to intersegmental membrane T8-tegumen, with very broad, oval anterior lobes closely appressed to tegumen and intersegmental membrane, with lateral laminae extended ventrally from base of anterior lobes and fused along posterior margin of intersegmental membrane; in dorsal aspect (Fig. 275) distal projection narrowly elongate, sides shallowly concave or straight, apex U- or V-emarginate, appearing bilobate, lobes asymmetrical with lobe larger than right one, surface of projection medially with pair of small, rounded, eye-like, transluscent "windows"; in lateral aspect (Fig. 276) distal half of projection with pair of ventral, longitudinal, parallel, asymmetrical crests projected ventrally, right crest bilobate, left one unilobate. Intersegmental membrane moderately sclerotized, extended and in form of hood over base of socii-gnathos. Tegumen with narrow, almost parallel-sided anterior emargination (Fig. 273), each half suboval in lateral aspect, posterior margin slightly sinuate near pedunculus, pedunculus wide. Socii straight, parallel, in lateral aspect pointed obliquely and ventrally, with sparse, very short setae (Fig. 272). Gnathos with proximal paired arms equal, with pair of caudally projected, digitate, very finely setose lobes near junction with distal arm (just ventrad of anus) (Fig. 272); single distal arm basally sharply bent, projected caudally and slightly upward, with broad apical hook (Fig. 272). Valvae with concavity of basal bridge protruded into small but prominent, partly transluscent lobe (Figs. 272, 274); anterior emargination of outer wall extended to about half length of valvae, very broadly U-shaped (Fig. 274), in lateral aspect (Fig. 272) valvae wide, with low, densely setose cucullar lobe, costa pre-apically emarginate, cucullus of right valva concave, that of left valva convex; ventral margin just below cucullar lobe produced into dorsally projected, crest-like lobe, lobe of right valva larger than that of left valva; anterior emargination of costa wider on left valva, with inner wall produced into longer crest than on right valva. Aedeagus (Figs. 272, 274) narrowly tubular, moderately sinuate, apical portion upcurved; dorso-basal crest low, left side just cephalad of manica with elongate-oval window with three or four tiny sclerotized, digitate lobes protruded from its margin.

Female genitalia. S6 transverse, convex, transluscent and lightly sclerotized anteriorly to melanized and well sclerotized posteriorly, with deep medial fovea near posteior margin. T7 (Fig. 351) elongate-rectangular, anteriorly shallowly emarginate, surface moderately sclerotized, anterior third more so, medially with pair of elongate-oval, transluscent areas. S7 very convex, markedly sclerotized but lightly melanized, anteriorly broadly , roundly emarginate, with longitudinal, unscaled area shallowly excavated into groove just before protruded lobe of posterior margin. T8 indistinctly sclerotized. S8 (Fig. 352) membranous, with dense, fine oblique wrinkles, latero-posterior lobes with dense cluster of erect setae; medial area with broad, longitudinal groove extended from middle to posterior margin. Sterigma (Fig. 352) with crescentic band very narrow, perpendicular to sternal surface. Ductus bursae fine, narrow and membranous throughout. Bursa (Fig. 395) slender, right portion not dilated. Ovipositor about 0.25x length of T1-T7, papillae anales tapered.

Variation. — *M. balli* varies mostly in coloration of upper surface of forewings. Palest specimens are almost pure ivory-white with an indistinct, paler, snowy white plical streak (Fig. 60). Intermediately colored specimens have the ground color of forewings ochreous-white, giving them a dirty white or almost pale drab appearance to the naked eye, contrasting with the very distinct snowy white plical streak, and have the plical streak posteriorly bordered by a fine brownish streak (Fig. 59). Darkest specimens are females and have the forewings ochreous-drab suffused with white, bringing into sharper contrast the white plical streak. The difference in tone between palest and darkest specimens, however, is not as marked as in other varied species such as *Scythris mixaula* . Variation in genitalia was not examined.

Geographical distribution and period of flight. — Known from southern California and western Arizona (Fig. 418). Adults have been collected from early April to mid June. The series from near Earp, San Bernardino Co. and from Chino Canyon, Riverside Co. (see 'Type material') were collected at blacklight. The paratype from Mazourka Canyon, Inyo Co. was collected on flowers of *Mirabilis Bigelovii* Gray (Nyctaginaceae) during day time.

Hostplant.— Unknown.

4.12 *Arotrura* Walsingham

(Figs. 49-50, 105, 124, 157, 277-281, 362-364, 399)

Arotrura Walsingham, 1888: 116. **Status re-established.**

Type species. — *Arotrura eburnea* Walsingham, 1888. Fixed by Walsingham (*loc. cit.*) by original designation and monotypy. Type repository: BMNH.

Derivation of generic name. — From the Latin *arotron* (= plow), and *oura* (tail); given in reference to the enlarged tergum 8 of male specimens which resembles a tail shaped like a plow. Gender: feminine.

Recognition. — Members of *Arotrura* are very large (including the largest North American scythridids), rather stout-bodied scythridids at once recognized by their immaculate ivory-white color (Figs. 49-50) and genitalia. In males tergum 8 is strikingly enlarged and plow-like (Figs. 280-281), the intersegmental membrane between tergum 8 and the tegumen is markedly sclerotized, medially humped and laterally flanged (Fig. 277), and the aedeagus is a large tube with the base ankylosed by a semi-rigid diaphragma (Fig. 279). In females the ostium is very wide and surrounded by a slightly protruded, membranous, stubby cone, the distal portion of the ductus bursae is widened, and sternum 8 has a bottle-shaped, moderately sclerotized plate posterior to the ostium (Fig. 364). Female specimens also have the abdominal terga 1-5 dark ochreous or pale brown, contrasting with the whitish terga 6-7. In external appearance they very closely resemble members of *Aeciatus* (Fig. 51) (see under that genus for differences) and pale, immaculate specimens of *Scythris mixaula* (Fig. 6)but are somewhat larger. They are easily distinguished from the latter by the well developed, conspicuous haustellum and in the females by the two-bristle frenulum (haustellum reduced and inconspicuous and frenulum with three bristles in *S. mixaula*), as well as by features of the genitalia (see under *Scythris*). The contrasting coloration of the abdominal terga of females is also a feature distinguishing *Arotrura* from other pale, immaculate scythridids, although some specimens of *Aeciatus* have the same terga somewhat infuscate.

In addition to specimens of *S. mixaula* and members of *Aeciatus*, several undescribed species of scythridids occasionally or commonly have pale specimens resembling *Arotrura* in color but they can usually be superficially separated from the latter by the presence of at least a few scattered dark scales on the upper surface of the forewings. In features of the genitalia however, these species are strikingly distinct from *Arotrura* .

Description. — Habitus. Very large, rather stout scythridids.

Color. Immaculate. Entire body (except terga 1-5 of females) and upper surface of forewing ivory-white. Ventral surface of fore- and hindwing and upper surface of hindwing pale greyish-ochreous. In females terga 1-5 ochreous or pale brown contrasting markedly with pale terga 6-7.

Head (Fig. 105). Face slightly wider than high, in profile very broad and moderately convex. Scales as in *Scythris* . Eyes very large and bulbous, interocular index 0.81, moderately rounded, suborbicular in outline. Fronto-clypeal ridge slightly convex. Transfrontal sulcus markedly delineated, not impressed. Gena broad. Pilifers markedly protruded below fronto-clypeal ridge. Occipital ridge angulate; occipital sulcus indistinct. Temporal sulcus distinct, not impressed. Post-occipital region in lateral aspect flat or markedly concave. Postgena in lateral aspect narrow. Ocelli absent. Haustellum very long, extended to middle or apex of abdomen. Antenna filiform, long, extended to two-thirds of forewing; scape with ventral pecten of 15-20 setiform scales in proximal three-quarters; flagellum with 56-57 articles, ventrally densely ciliate, cilia shorter than width of article. Maxillary palpi with four articles, folded over base of haustellum, conspicuous. Labial palpi upcurved, relatively long, extended slightly beyond level of vertex, LP/HH = 2.25, article 2 about 1.5x length of article 1.

Thorax. Prothorax as in *Scythris* except: pronotum with antero-ventral markedly thickened, median carina distinct; sternum markedly concave, without carina; furcal process without intercoxal lamella; ventro-lateral margin of sterno-pleural bridge broadly and regularly rounded.

Mesothorax as in *Scythris* except: epimeron with marked trans-epimeral sulcus; upper sector of precoxal suture absent; lower sector of precoxal suture curved mediad; pre-episternum without transluscent zone; margino-pleural abbreviated (Fig. 124).

Metathorax as in *Scythris* except: metascutum with shallow lateral impression. Metascutellum trapezoid, anterior margin sinuate, anterior angles markedly prominent, sides shallowly concave. Metepimeron without trans-epimeral sulcus. Furcal apophysis low, short, attached apically to furcal process, anterior projections very broad, subtriangular, broadly united to short posterior projections.

Legs as in *Scythris* except without additionnal pre-apical spine on tarsomeres.

Wings (Fig. 157). Forewing lanceolate, broadest in middle, FL/FW = 4.3-4.9, as broad as, or slightly broader than, hindwing, FW/HW = 1.0-1.1, apex acute, termen markedly sinuate. Hindwing lanceolate, HL/HW = 3.9, broadest in basal third, costa bulged in basal third, termen sinuate. Venation and retinaculum as in *Colinita* . Frenulum in males with one bristle, in females with two bristles. Frenum absent.

Male abdomen. T1-T2 suture partially double, with T2 anterior margin complete, preceded by medial fold. T3-T5 membranous, anteriorly margined. T6-T7 with very small, lightly sclerotized, medial area, T7 unmargined. T8 (Figs. 280-281) markedly differentiated from preceding terga and heavily sclerotized, extended above genitalia and probably functional part of the latter, ventro-medially fused to heavily sclerotized intersegmental membrane T8-tegumen, plow-like in lateral aspect (Fig. 281) with large ventro-medial, curved, sparsely setose process, in dorsal aspect somewhat arrow-shaped, with prominent, setose medio-lateral angles and slender anterior lobes bracing lateral portions of tegumen. Intersegmental membrane T8-tegumen markedly sclerotized, dome-shaped (Fig. 277), relatively short with portion extended above base of socii and gnathos about 0.25x length of genitalia, medio-longitudinally crested and laterally produced into ventrally directed, heavy flanges bracing base or gnathos and socii; latero-basal portions very broad, larger in area than, and covering most of, tegumen halves. S2 with apodemes extended on sternal surface as indistinctly delineated venulae, unscaled area between venulae with irregular, somewhat Y-shaped ridge. Sterna unmargined. S2-S6 and S8 moderately sclerotized, with ragged edges. S4-S6 medially divided by longitudinal membranous zone. S7 membranous. S8 very small, transversely rectangular, pleural lobes moderately sclerotized, prominent.

Male genitalia. Proportionally very large relative to abdomen, symmetrical. Tegumen broad, divided into two halves by deep, relatively narrow, V-shaped emargination, halves dorso-medially joined by narrow bridge and in form of broad, high, vertical arch above base of ventral part of genitalia; each half broadly oval-triangular in lateral aspect (Fig. 277), widest point about 0.20x length of whole genitalia; dorso-medial bridge with posterior margin shallowly invaginated; pedunculus barely constricted, incurved, articulated in socket formed by concavity of outer wall of base of valva. Base of 10th segment (socii-gnathos) fused to tegumen inside invagination of posterior margin, medio-longitudinally grooved and with elongate patch of rugulose cuticle on each side of groove. Socii (Figs. 277-278) as markedly sclerotized, elongate, simple, slightly divergent, sparsely setose rods, in lateral aspect (Fig. 277) basal third downcurved and distal two-thirds straight and projected caudad at right angle from basal part. Gnathos (Fig. 277) wishbone-shaped, small, of delicate appearance, directed ventrally, paired basal arms attached near base of socii, parallel, distal arm shorter and somewhat wider than proximal ones, apically hooked. Vinculum (Fig. 279) inconspicuous, reduced to narrow, U-shaped rim indistinguishably fused to base of valvae. Valvae (Figs. 277-279) symmetrical, basally fused, anteriorly deeply U-emarginate, emargination about 0.30x length of valvae; inner wall markedly concave, almost trough-like in medial third; costa with very large, prominent cucullar lobe with inner side covered with dense, short setae; ventral margins medially dilated and contiguous, with dorsally protruded, warped flap; distal third tapered. Juxta seemingly absent. Diaphragma anteriorly expanded into deeply invaginated chamber with ventral portion sclerotized and enclosing aedeagus ventrally and laterally, anterior end of chamber attached to base of aedeagus (Figs. 277, 279). Aedeagus relatively large (Fig. 279), about 0.50x length of genitalia, tubular, slightly upcurved, ankylosed and partly enclosed by sclerotized lower diaphragma, basal two-thirds dorsally with longitudinal, transluscent "window", distal third with 2-3 small, blunt teeth. Bulbus ejaculatorius undeveloped.

Female abdomen. T1-T2 as in male. T2-T5 lightly sclerotized, T3-T5 with fine anterior margin. T6-T7 markedly sclerotized. T6 transversely rectangular, medially divided into two lateral halves by transluscent groove lined with very firmly attached scales (scales difficult to remove even with a needle). T7 (Fig. 363) elongate-sublinguiform, convex, anterior margin produced into triangular flap extended beneath groove of T6, medio-posterior portion with deep fovea covered with very firmly attached scales. S2 as in male. S2-S5 moderately to markedly sclerotized, S6-S7 most sclerotized of sterna. S7 (Fig. 362) markedly convex, with deep medio-longitudinal groove lined with firmly attached scales, groove posteriorly prolonged into prominent membranous lobe protruded beyond posterior margin.

Female genitalia (Figs. 364, 399). T8 very indistinctly sclerotized, apical margin with fine setae. S8 (Fig. 364) distinctly sclerotized, posterior half subquadrate, apical margin indistinct with fine setae, anterior half gradually narrowed cephalad, anterior margin fishtail-like and partly overlapped by sterigma; surface with fine pointed microsculpture and with scattered fine setae. Sterigma as membranous, semi-rigid, broad, short, truncate cone situated at anterior margin of S8. Ostium at apex of sterigma cone, pointed caudally, wide, oval. Ductus bursae with proximal half widened into lightly sclerotized antrum, antrum anteriorly tapered, curved leftward (Fig. 364); anterior half of ductus (Fig. 399) membranous, fine, twisted or bent just cephalad of antrum, inception into anterior end of bursa. Corpus bursae (Fig. 399) very large, almost as long as abdomen, anterior two-thirds elongate, subellipsoid-ovoid, distal third moderately narrowed as tubular ductus seminalis. Spermatheca not examined. Anterior apophyses straight, subparallel, attached latero-medially on T8, about 1.5x length of T8. Posterior apophyses slightly thinner than and about 1.5xlength of anterior ones. Ovipositor about 0.40x length of T1-T7, papillae anales narrow, tapered, very slightly sclerotized, sparsely setose on all sides.

Monophyly and relationships. — Monophyly of *Arotrura* is indicated by the shape of tergum 8 of males and dome-shaped intersegmental membrane T8-tegumen with lateral flanges. *Arotrura* is inferred to belong to a larger monophyletic lineage which includes the five other genera treated below and whose males have the aedeagus ankylozed basally.

Included species and generic diversity. — The type species is the only known member of this genus. I have seen no other undescribed species in collections which might be congeneric with *A. eburnea* .

Geographical distribution. — Known only to occur in Arizona, New Mexico and westernmost Texas (Fig. 413). Further collecting may reveal the genus in desert areas of northern México.

Natural history. — Immature stages and foodplants are unknown. Adults are nocturnal.

4.13 *Aeciatus* new genus

(Figs. 51, 282-284, 293, 354-358)

Type species. — *Aeciatus formidabilis* new species, by present designation. Type repository: UCB.

Derivation of generic name. — A compound name derived from *aikia* (Gr., f., = torture), and *-tus* (L. = suffix meaning having the nature of); given in reference to the heavily armed male genitalia which reminds of a vicious instrument of torture. It is masculine.

Recognition. — Members of *Aeciatus* are large, immaculate, ivory-white scythridids (Fig. 51) confusingly similar to *Arotrura* specimens although they are, on average, smaller than the latter. Females of *Aeciatus* have the basal abdominal terga somewhat darker than the distal terga, though not as pronouncedly contrasting as in *Arotrura* females. *Aeciatus* is readily distinguished from *Arotrura* and from all other scythridids by characters of the male and female genitalia. In males tergum 8 (Fig. 293) is somewhat hood-like, distally narrowed, with a subclavate apex, the socii are heavy, medially fused, apically spear-like or sagittate (Figs. 282-283), the aedeagus has a pre-apical bifid projection (Fig. 284) and the valvae have one or two large, medial, thorn-like processes (Fig. 283). In females sternum 8 bears a large, linguiform and protruded plate (Fig. 354). External differences between *Aeciatus* and nearly immaculate specimens of *Scythris mixaula* are as given for *Arotrura* .

Description. — Skeletal traits of the head and thorax were not studied from potash-cleared specimens.

Habitus. Large, stout scythridids.

Color. Immaculate. Entire body, except terga 1-5 of females and ventral surface of forewings, ivory-white (Fig. 51). Ventral surface of forewing pale greyish-ochreous. In females terga 1-5 variously ochreous, rufous or pale brownish, moderately contrasting with ivory-white terga 6-7.

Head. Face, eye, haustellum, antenna and palpi about as in *Arotrura* (except relative measurements not taken); flagellum with 47-49 articles.

Thorax. Skeletal characters not studied.

Wings. Forewing lanceolate, broadest in middle, FL/FW = 4.6-4.8, as broad as, or slightly broader than, hindwing, FW/HW = 1.0-1.2, apex acute, termen slightly sinuate. Hindwing lanceolate, HL/HW = 3.8-4.0, broadest in basal third, costa bulged in basal third, termen slightly sinuate. Venation as in *Colinita* except as follow: forewing with M3-CuA1 in males with very short stalk, in females forked and with base contiguous with that of M2 (M2-M3-CuA1 appearing trifurcate). Retinaculum as in *Scythris*. Frenulum as in *Arotrura*. Frenum absent.

Male abdomen. T1-T2 suture with partially double margin as follow: T2 anterior margin laterally developed and medially interrupted, T1 posterior margin medially developed and laterally interrupted, or complete. Terga membranous, T3-T5 with fine anterior margin. T8 (Fig. 293) markedly differentiated and sclerotized, extended above genitalia, somewhat spear-shaped in dorsal aspect with long, slender antero-lateral lobes extended inside abdomen to middle of T6, distal portion digitate, apically dilated, blade-like in lateral aspect; pleural lobes prominent. Intersegmental membrane T8-tegumen sclerotized, hood-shaped (Figs. 282-283), relatively short, portion extended above base of socii and gnathos about 0.25x length of genitalia. S2 with short apodemes about 0.10x length of sternum, venulae present, fine, about 0.30x length of sternum, unscaled area as in *Hyalinixys*. S2-S5 lightly sclerotized, S3-S5 semi-circular in outline. S6-S8 membranous, S8 very lightly sclerotized, subquadrate, small, about 0.50x size of S7.

Male genitalia (Figs. 282-284, 293). Large, broad, almost as wide as long, symmetrical. T8 (Fig. 293) with distal portion (portion projected beyond posterior margin of 8th segment) extended to apex of valvae, narrowly triangular, ventrally somewhat dilated, apically moderately dilated, laterally lined with short, ventro-medially with barely protruded, or without, lobes, erect setae, anteriorly produced into large, slender lobes extended inside abdomen to level of T6, emargination between lobes broadly U-shaped. Tegumen markedly transversely arched (Fig. 283), divided into two lateral halves by deep, antero-dorsal, V-emargination, halves narrowly joined dorsally by posterior margin and by sclerotized basal portion of 10th segment (socii-gnathos); each half in lateral aspect higher than wide, somewhat roundly triangular or rudder-like (Fig. 282), anterior margin narrowly inflexed, latero-posterior margin almost straight; pedunculus not distinctly differentiated from side of tegumen, articulation thickened, incurved, socketed into concavity of outer wall of base of valva. Uncus absent. Base of 10th segment with surface rugulose (Fig. 283). Socii symmetrical, heavily sclerotized, long, about 0.50x length of genitalia, fused together from base to about three-quarter of length, appearing sagittate with bifid apex (Fig. 283); basal quarter as two subquadrate plate, followed by marked constriction; distal three-quarters gradually broadened, laterally lined with erect setae, with pre-apical, lateral, spiniform process; socii sigmoid in lateral aspect, with base projedcted caudally and distal three-quarters bent and curved ventro-caudally. Gnathos (Fig. 282) of delicate appearance, wishbone-like, projected ventrally, symmetrical; proximal, paired arms arising at about level of constriction of socii, distal projection short, about one third length of proximal arms, apex with very small hook. Vinculum (Fig. 284) thin, flap-like or linguiform, pointed posteriorly beneath valvae, relatively broad, extended to third or half of valvae, base fused to antero-ventral margin of valvae, medially with dorsally protruded, longitudinal ridge or hump. Valvae articulated to tegumen (Fig. 282), medio-basally fused together (Fig. 284), symmetrical, base emarginate caudad to about one third length of valvae; costa with prominent, densely setose cucullar lobe, medially with incurved, dentiform process cephalad of cucullus; apex tapered, lobate; inner wall medially armed with one or two large, heavily sclerotized, dorsally projected spines (Figs. 282-283), anterior quarter or half of wall membranous. Diaphragma membranous, without sclerites, inwardly expanded above and laterad of aedeagus, attached to membranous anterior portion of inner wall of valvae. Juxta

(Figs. 283-284) as broad plate, base bifurcate, fishtail-like, articulated to base of vinculum-valvae, pointed cephalad in ventralmost plane of genitalia, surface dorsally humped; anterior apex articulated to antero-ventral wall of aedeagus. Aedeagus ankylosed by juxta, markedly dorsally arcuate (Fig. 282), tubular, with base laterally dilated into pointed projections and appearing sagittate or fishtail-like (Fig. 284); apex abruptly narrowed and downcurved, almost hook-like, with pre-apical, bifid projection. Bulbus ejaculatorius little developed, rather inconspicuous.

Female abdomen. T1-T2 suture doubly margined. T1-T5 membranous or very slightly sclerotized, T3-T5 anteriorly finely margined. T6 more sclerotized than preceding terga, anteriorly conically invaginated beneath T5, invagination posteriorly with shallow, oval concavity. T7 elongate-subrectangular, most sclerotized or terga. S2 as in male. Sterna lightly to moderately sclerotized, more so than terga, anteriorly unmargined. S6 anteriorly with semicircular invagination beneath S5 and with markdely wrinkled area behind invagination. S7 most sclerotized of sterna, broadly transverse, anteriorly roundly emarginate, posterior margin with protruded, membranous lobe, scales of medial area very firmly attached.

Female genitalia. Intersegmental membrane S7-S8 (Fig. 354) posteriorly markedly expanded, semi-rigid, folded over base and sides of S8 (thus 8th segment in effect half recessed under 7th). T8 moderately sclerotized, markedly convex, narrow, cylindrical in cross-section, with surface finely granular, distal half with medial, V-shaped, transluscent area, caudal margin with scattered, fine setae. S8 (Figs. 354-356) unmelanized, of complex appearance, with two markedly sclerotized plates: membranous part semi-rigid, baso-laterally dilated, distally tapered, ± pear-shaped, surface with fine isodiametric or granular microsculpture; first plate anterior, linguiform or spatulate, attached to anterior margin, projected off and parallel to sternall wall (Figs. 355-356), as long as or longer than, and covering most of sternum, anteriorly with deep emargination, apically notched; second plate medial, covered by anterior plate and somewhat difficult to distinguish, horseshoe-shaped or circular, deeply concave or invaginated. Ostium rather narrow, difficult to distinguish, recessed, situated medially in deepest part of fold of intersegmental membrane S7-S8 cephalad of anterior plate of S8 (Figs. 354, 356). Sterigma developed as narow, transverse band around ventral side of ostium. Ductus bursae wholly membranous, ribbon-like, inserted at anterior (?) end of bursa. Corpus bursae of uncertain shape (not fully inflated in specimens examined), seemingly elongate with medial constriction; ductus seminalis at end of bursa opposite to that of inception of ductus bursae, indistinguishably continued into vestibulum of vagina. Spermatheca not studied. Anterior apophyses thick, straight and slightly divergent, about twice length of T8, base attached antero-laterally on T8. Posterior apophyses about 1.6x length of, and as thick as, anterior ones, insertion on papillae anales Y-shaped. Ovipositor long, about 0.50x length of T1-T7; papillae anales (Figs. 357-358) of rigid membrane, dilated, globulous, with scattered erect seate, medio-apically lined with two markedly sclerotized, lamellar ridges.

Note about female genitalia. — The position of the ostium in female specimens of *Aeciatus* is difficult to determine if the genitalia are examined in the standard, ventral orientation (Fig. 354), because the two markedly sclerotized, overlapping plates of sternum 8 and the folds of the expanded, semi-rigid intersegmental membrane between sterna 7 and 8 result in a confusing configuration, with structures being difficult to discriminate from one another. The proximal part of the relatively thin ductus bursae extended from the ostium inside the intersegmental membrane S7-S8 also tends to blend with the folds of that membrane. From a ventral aspect, one is led to interpret the medial plate of S8 as indicating the position of the ostium because of its shape: it is horseshoe-shaped (*A. formidabilis*) (Fig. 354) or circular (undescribed species of *Aeciatus*) and thus reminds of the entrance of an opening. In its horseshoe shape, it resembles, and is in the same position as, the sterigma which anteriorly lines the ostium in species of *Meniscotus* . In lateral aspect (Figs. 355-356), the plate appears concave and further conveys the impression of concealing an opening. Insertion of a fine needle in that concavity, however, reveals that it is not opened. Insertion of a needle between the fold of the intersegmental membrane S7-S8 and the large anterior plate immediately reveals the position of the ostium through which the needle tip passes and enters the base of the ductus bursae.

Monophyly and relationships. — Monophyly of *Aeciatus* is indicated by the presence of large, furcate spines on the inner wall of the valvae of males and the sclerotized ridges of the ovipositor of females. *Aeciatus* is inferred to be closely related to *Mimiella* based on the synapomorphic feature of medially fused socii with distal, horn-like spines.

Included species and generic diversity. — The type species is the only described member of this new genus. In addition, another undescribed, closely related species occurs in southern California.

Geographical distribution. — Known only from Arizona and southern California.

Natural history. — Immature stages and foodplants are unknown. Adults are nocturnal.

4.13.1 *Aeciatus formidabilis* new species

(Figs. 51, 282-284, 293, 354-358, 417)

Type material. — HOLOTYPE, male, labelled: Kingman, Arizona, 15.v.1939, Geo. Willet collector [two white, partly printed, partly handwritten labels] (LACM). PARATYPES, 31 males, 3 females. ALLOTYPE, female, labelled same as holotype (LACM). Eight males, one female: labelled same as holotype (6 in LACM, 3 in USNM); one male genitalia on slide no. JFGC 2599 (USNM), female right wings on slide no. JFL-85-0419 (specimen without abdomen; USNM). Seven males: Ajo, Pima Co., Arizona, [date].iii.1923, O.C. Poling (two males: 1-15.iii.23, five males: 15-30.iii.23) (USNM); one with genitalia and left wings on slide no. JFL-84-0065. Three males: Sells P.O. Indian Oasis, Pima Co., Arizona, [date].iii.1923, O.C. Poling (one male: 1-15.iii.23, two males: 15-30.iii.23) (USNM); one with right wings on slide no. USNM 12562. One male: Phoenix, Maricopa Co., Arizona, 25.iv.1981, at UV light, R.S. Wielgus. Six males (four stacked on the same pin), one female: "En route Dewey to Salome, Ariz.", May 8-15 except one male dated "April" (USNM); one male from stack with genitalia on slide no. JFL-82-1022, female genitalia on slide no. JFL-85-0301. One male: Yuma Co., Arizona, desert, no date (USNM); genitalia on slide no. JFL-81-1005. Two males: Mohave Co., Arizona, one dated 1-7.v (no year) (USNM). One male: Yavapai Co., Arizona, no date (USNM). Two males: Clarke Co., Nevada, one dated 16-23.iv (no year), one dated 24-30.iv (no year) (USNM).

Type locality. — Kingman, Mohave Co., Arizona.

Condition of holotype. — Spread, pinned with minuten pin and double-mounted, undissected, in good condition.

Derivation of specific epithet. — From the Latin *formidabilis*, meaning formidable or fearsome; given in reference to the fearsome appearance of the male genitalia.

Recognition. — Separation from other similar-looking scythridids is indicated in the generic diagnosis. Specimens of *A. formidabilis* are externally indistinguishable from those of the other undescribed species of the genus, but are easily separated in both sexes on characters of the genitalia. Males of *A. formidabilis* have the apex of T8 roundly dilated (Fig. 293), the socii distally broad, about 3x as wide as basally with very prominent, lateral, spiniform projections (Fig. 283), the inner wall of the valva with a single, thorn-like projection (Fig. 283), the vinculum distinctly shorter than wide (Fig. 284) and barely extended to the apex of the gnathos with an oval dorsal hump, and the bifurcate apex of the aedeagus shorter than the curved ventral portion bearing the phallotreme. In males of the undescribed species, the apical dilatation of T8 is angulate; the socii are more slender, distally no more than twice as wide as basally with small lateral projections; the vinculum is large, at least as long as wide with a medio-dorsal, narrow, longitudinal ridge; the inner wall of the valva has two thorn-like projections with one being prolonged into a low ridge, and has a third, more anterior, irregularly shaped lobe; and the bifurcate part of the apex of the aedeagus is longer than the ventral curved tube bearing the phallotreme. Females of *A. formidabilis* have the anterior plate of S8 parallel-sided, linguiform, narrower than and not extended to the apex of the sternum, and the medial plate of S8 horseshoe-shaped (Fig. 354). In females of the undescribed species, the anterior plate of S8 is markedly dilated, wider than the sternum, spatulate; with the apex extended beyond the posterior margin of the sternum, and the medial plate of S8 is circular, with a pit-like depression just caudad of it.

Description. — Size. Forewing length 7.2-9.1 mm (mean = 8.1); hindwing length 6.0-7.9 mm (mean = 7.2); wing expanse 14.8-19.8 mm (mean = 17.7) (15 specimens).

Head. Face and neck tufts dull ivory-white, or yellowish in some older, slightly discolored specimens. Eye relatively large, convex, somewhat narrower than frons. Haustellum base with ivory-white or ochreous scales. Antenna: scape dull ivory-white mixed with some ochreous; pedicel and flagellum dorsally metallic golden, brassy or cupreous. Labial palpi extended to vertex, article 1 snowy white, articles 2 and 3 ivory-white, ventro-medially ochreous or tan, in several specimens most of ventral surface ochreous or tan.

Thorax. Dorsal surface colored as face, immaculate. Ventral surface snowy white, lustrous, ochreous in older, discolored specimens. Foreleg with coxa ivory-white or ochreous, outer surface of femur, tibia and tarsus drab with metallic golden or cupreous lustre, inner surface white. Middle and hind leg white, lustrous or with light metallic reflexion, tarsi with outer surface drab with golden or cupreous metallic lustre.

Wings. Forewing upper surface colored as face, immaculate (Fig. 51); ventral surface uniformly ochreous-drab or light tan; cilia colored as upper surface. Hindwing upper surface very pale brownish-drab or brownish-ochreous, lustrous, slightly darker around margins; ventral surface off-white; cilia colored as those of forewing.

Abdomen. In male, upper surface snowy white, lustrous, in several specimens T2 and T3 with some ochreous; pleural tufts of 8th segment prominent, dense, extended almost to apex of T8, ivory-white; T8 (Fig. 293) surface covered with long, hair-like scales as those of pleural tufts, contrasting with short, oval scales of preceding terga; ventral surface snowy white, in many specimens mixed with some ochreous or with overall ochreous tinge, in some specimens lateral portions of S2 and S3 drab. In female, upper surface with T1 lustrous white, T2-T5 mostly rufous with slight iridescent hue and laterally paler, ochreous, T6 and T7 rufous-drab, gradually paler, ochreous or ivory-white toward apex of abdomen, lustrous or slightly iridescent; ventral surface medially white, laterally pale drab, lustrous.

Male genitalia (Figs. 282-284, 293). T8 with apical portion lobate or subcordiform. Socii distally dilated, broadest part about 3x wider than narrowest subasal part; lateral spiniform projection large, prominent. Vinculum transverse, medial length shorter than width, posteriorly barely extended to apex of gnathos, dorsal surface with medial, oval hump. Valvae with ventral (inner) margin straight, inner wall with single, medial, large, incurved and dorsally projected, thorn-like process, thorn simple or bifid. Aedeagus with pre-apical bifurcate process shorter than downcurved, apical portion.

Female genitalia (Fig. 354). As in generic description except: S7 with narrow, transluscent area anterior of caudo-medial, protruded lobe. S8 with anterior plate parallel-sided, linguiform, narrower than sternum, with apex not extended to posterior margin of sternum; medial plate horseshoe-shaped; posterior margin of sternum roundly emarginate, slightly

Variation. — No significant variation in external features other than size was observed in specimens examined. In male genitalia, the thorn-like process of the inner wall of the valva is bifid (in two genitalia preparations) or simple with a bare suggestion of a secondary tooth (in one preparation). Variation in female genitalia was not examined.

Geographical distribution and period of flight. — Known to range in southernmost Nevada and Arizona in areas of Sonoran desert (Fig. 417). Adults have been collected from about mid-March to late May. They are nocturnal and have been collected at blacklight (ultra-violet).

Hostplant. — Unknown.

4.14 *Mimiella* new genus

(Figs. 53-54, 108, 125-126, 134, 140, 143, 158, 162-164, 285-288, 353, 396)

Type species. — *Scythris divaricata* Braun, 1923, by present designation. Type repository: CAS.

Derivation of generic name. — Named after my wife's nickname, Mimi. I take pleasure in dedicating this genus which comprises elegant-looking scythridids to my wife for her unrelented and loving support throughout this difficult, protracted, and often frustrating study of scythridid moths. Gender: feminine.

Recognition. — Similar in color and size to specimens of *Colinita* , *Commodes* , *Hyalinixys*, *Oncoxystus* and *Serangites* , but easily separable from them by features of the genitalia. In males (Figs. 285-286), the socii are distally fused and have a characteristic, apically bihorned profile (in species whose points are pronounced, the lateral aspect of socii are reminescent of the head of a ceratopsian dinosaur), the aedeagus is a simple, slightly upcurved tube with a bulbous base and the valvae are symmetrical, variously upcurved and unarmed blades, basally with a characteristic "shouldered" appearance in ventral aspect. In females (Fig. 353), the sterigma is a proboscis-like tube with an oblique, spout-like apex and bears a wide ostium. Many specimens have a characteristic transverse, zigzagged white or whitish fascia in the basal third of forewing (Fig. 53), similar in outline to the dark fascia of *Colinita* specimens. Pale, ivory-white specimens externally resemble members of *Arotrura* and *Aeciatus* but differ in having at least some brown or dark scales on the forewings.

Description. — Description of skeletal characters of head and thorax is based on examination of specimens of *M. divaricata* and of an undescribed species.

Habitus. Medium-large to very large, slender scythridids.

Color. In most specimens ground color of body whitish or ivory-white, densely suffused or peppered with drab, grey or grey-brown. Upper surface of forewing predominantly grey or brown, finely and diffusely streaked (Fig. 54), in many specimens with transverse zigzagged white fascia in basal third (Fig. 53). Hind wing paler than forewing. In some specimens body almost completely ivory-white with fine and scattered brownish suffusion on upper surface of forewing. No pronounced color differences between sexes, or in some species females with dorsal surface of abdomen paler than in males.

Head (Fig. 108). Head and its appendages as in *Commodes* except: interocular index 0.77-0.86; fronto-clypeal ridge straight; occipital ridge sharply angulate and narrowly grooved; temporal sulcus distinctly marked and impressed; antennal flagellum long, with 48-64 articles; LP/HH = 2.37-2.56; article 2 very elongate and more than twice length of article 1.

Thorax. Prothorax as in *Scythris* except: pronotum laterally rounded, indistinctly shouldered, antero-ventrally markedly thickened, median carina indistinct; sternum with indistinct or without medina carina, joint with furcal process membranous; posterior margin of furca broadened by additional thin lamella.

Mesothorax (Figs. 125-126) as in *Scythris* except: epimeron with trans-epimeral sulcus complete and distinct, or incomplete and somewhat indistinct, connection with dorsal arm broad; upper sector of precoxal suture absent; lower sector of precoxal suture straght or curved mediad, surounded by transluscent area; margino-pleural abbvreviated or indistinctly extended to half width of katepisternum.

Metathorax as in *Scythris* except: metascutellum with prominent anterior angle, anterior margin sinuate, lateral margins concave, postero-median longitudinal carina suggested. Metepimeron with indistinct trans-epimeral sulcus. Intercoxal lamella very thin and slightly sclerotized. Furcal apophysis (Figs. 140, 143) very low, attached to subapical part of furcal process, anterior projections very broad, rounded or triangular, lightly sclerotized; anterior portion of furcal process narrow in lateral aspect.

Legs as in *Scythris* except without additionnal pre-apical spine on tarsomeres; in some species (*e.g. M. divaricata*) apical spines of tarsomeres 1-4 quite large, equal to at least half length of last tarsomere.

Wings (Figs. 158, 162-164). Forewing lanceolate, broadest in middle, FL/FW = 5.0-5.7, as broad as, or slightly broader than, hindwing, FW/HW = 1.0-1.2, apex pointed or acute, termen straight or indistinctly sinuate. Hindwing lanceolate, HL/HW = 3.9-5.0, broadest in basal third, costa bulged in basal third, apex acute, termen sinuate. Venation as in *Colinita* except: forewing in some species with M2-M3 forked and CuA1 separate, or M2 separate and M3-CuA1 forked (Fig. 162) or M3 and CuA1 connate and forked with M2 (Fig. 164), CuA1 obsolete or well developed; hindwing with M2 and M3 forked, stalked or connate and forked with CuA1 (Fig. 163). Retinaculum as in *Scythris* . Frenulum as in *Arotrura* . Frenum absent.

Male abdomen. T1-T2 suture singly margined, T1 posterior margin developed only medially as short fold, T2 anterior margin medially invaginated. T2-T7 membranous to moderately sclerotized, anteriorly margined, when sclerotized then stiff and tending to curl. T8 (Fig. 288) markedly differentiated and sclerotized, extended above genitalia, fused to latero-posterior margin of sclerotized intersegmental membrane T8-tegumen, hood-like, conical or truncate, in many species with medio-lateral, digitate process projected caudally, anteriorly without slender lobes or apodemes. Intersegmental membrane T8-tegumen sclerotized, as irregularly developed, short flap, not extended over lateral portions of tegumen and barely extended beyond its postero-dorsal margin, protruded portion barely covering extreme base of socii and gnathos and about 0.10-0.20x length of genitalia. S2 with well developed apodemes 0.15-0.20x length of sternum, in some species apodemes barely developed and stubby, lobe-like; venulae distinct or indistinct, as somewhat diffuse, sclerotized bands, 0.30-0.40x length of sternum; unscaled area not medially ridged. S3-S8 markedly sclerotized and darkly melanized, markedly contrasting with almost hyaline terga, tending to curl. S3 densely, finely, transversely wrinkled. S8 linguiform, transversely rectangular or conical, about half size of S7.

Male genitalia (Figs. 285-287). Symmetrical. Tegumen vault-like, partially divided into two broad, convex, lateral lobes by narrow or moderately broad, V- or U-shaped anterior emargination extended to two-thirds or four-fifths of length of tegumen (Fig. 286), in few species tegumen completely divided by emargination with lateral lobes joined dorso-posteriorly by basal plate of 10th segment (socii-gnathos) and by narrow posterior margin, in few species posterior margin medially produced into triangular point fused with 10th segment; in lateral aspect (Fig. 285), each half or lobe extended completely cephalad of, and not overlapping, valvae, broadly crescentic, semi-circular, semi-elliptic or bow-like in outline, anteriorly rounded, posteriorly moderately or markedly concave, ventral and anterior portions of wall very broadly inflexed, tegumen thus appearing partially closed (almost completely so in some species) in ventral or anterior aspect (Fig. 287); pedunculus clearly differentiated in ventral aspect by marked sinuation of posterior, inflexed part of ventral wall, apex markedly thickened and oriented in transverse ventral plane of genitalia, perpendicular to lateral wall of lobe, articulated with socket formed by margin of transverse base of valvae (Fig. 287). Segment 10 (socii-gnathos) with relatively short, quadrate or narrowly transverse, basal plate about 0.15x length of genitalia or shorter, with partly (laterally) (Fig. 286) or entirely rugulose surface. Uncus absent. Socii markedly sclerotized, elongate, about 0.25-0.40x length of genitalia, distally fused together by transverse bar at about three-quarter or four-fifth of length; in lateral aspect (Fig. 285) rather broad with notched and pointed apex and having striking horned appearance (in many species, reminescent of the head of a ceratopsian dinosaur); in dorsal aspect (Fig. 286), medio-longitudinally grooved, in most species groove invaginated into lobate, membranous or sclerotized, concavity with walls appearing punctate from many very small orifices, apex notched, laterally with erect setae, proximal half with dense dorsal patch of anteriorly projected, erect or semi-erect setae, in some species setae very long and setal patches with bushy or brush-like appearance. Gnathos (Fig. 285) wishbone-shaped, of delicate appearance, relatively small, symmetrical, paired proximal arms arising contiguous to base of socii, subequal or slightly longer than single distal arm, slightly downcurved or straight, projected caudo-ventrally at acute angle from socii, single distal arm straight or variously downcurved, apex minutely hooked. Vinculum (Fig. 287) markedly reduced to thin, transverse, subcrescentic or subtriangular band fused to anterior rim of base of valvae, pointed posteriorly and very closely appressed to base of valvae and rather indistinct in ventral aspect. Valvae (Figs. 285-287) symmetrical, basally fused to vinculum in transverse ventral ridge and to each other by inner process formed by anterior angle of their ventral margins, base in ventral aspect with characteristically shaped, relatively shallow, U-shaped emargination extended to only about 0.10x length of valvae and narrow, less than one third width of base of valvae; valvae with very characteristic, basally "shouldered" ventral profile: broadest basally with short, abrupt antero-lateral constriction forming concave socket articulating with pedunculus, valvae caudally convergent, gradually tapered, apices subcontiguous or contiguous; in lateral aspect (Fig. 285), valvae simple, blade-like, slightly to markedly upcurved in most species, strikingly so in few species, almost straight in some species, costa with basal lobe or bulge, with rather dense, erect setae, in several species with pre-apical, pointed lobe. Diaphragma membranous, unmodified, without sclerotized plate or spines. Juxta (Figs. 285, 287) as very slender, slightly upcurved rod almost as long as aedeagus, posteriorly articulated to antero-medial process formed by fusion of valvae, extended cephalad inside tegumen, anteriorly fused to ventro-basal part of aedeagus; anterior portion with gradually widened lateral laminae expanded around base of aedeagus. Aedeagus (Fig. 285) ankylosed by juxta, simple, tubular, very slender and slightly upcurved or sigmoid, base roundly dilated or bulbous, phallotreme apical; bulbus ejaculatorius small, subovoid.

Female abdomen. Segments 1-6 as in male. T7 elongate-rectangular or subquadrate, markedly sclerotized, in some species convex or shallowly concave. S7 suboval or elongate-rectangular, markedly sclerotized, in some species anterior margin V-emarginate, medially with elongate, shallow concavity, posterior margin medially with hyaline emargination and with protruded, membranous, wrinkled lobe (Fig. 353); in some species intersegmental membrane between S6-S7 with conical invagination.

Female genitalia (Figs. 353, 396). T8 lightly sclerotized, medially membranous or indistinctly sclerotized, subquadrate, somewhat expanded latero-ventrally, posterior margin with V-emargination, surface with dense, finely pointed microsuclpture and with few fine, scattered setae. S8 entirely membranous with same finely pointed microsculpture as T8. Sterigma (Fig. 353) with proboscis-like appearance, as rounded or flattened tube about 1.0-2.0x length of S8, projected posteriorly from anterior margin of, and parallel to surface of, S8, side straight or medially constricted, slightly or moderately sclerotized, or almost membranous, in some species (*e.g. M. divaricata*) with medio-lateral membranous dilatation with very fine pointed microsculpture and 1-2 setae, apex spout-like in lateral aspect, laterally with cluster of few fine setae; in several species antero-lateral angles of tube produced internally into divergent apodemes (Fig. 353). Ostium apical or subapical on sterigma, facing ventrally, oval or rounded, very wide, almost as wide as apex of stergima. Ductus bursae with proximal (posterior) half or third relatively wide, almost as wide as ostium, embranous or lightly sclerotized, distal (anterior) half of two-thirds narrowed, flat, ribbon-like; inception at anterior end of, or medio-laterally on, bursa. Corpus bursae (Fig. 396) (examined in fully inflated condition in onnly three species) elongate-ellipsoid or ovoid, posteriorly abruptly constricted or gradually narrowed into ductus seminalis. Spermatheca not studied. Anterior apophyses relatively long, about 2.0-3.0x length of T8, thin, straight, in some species extended as lateral margins on T8. Posterior apophyses as thin as or thinner than, and about 1.5x length of, anterior apophyses, attached to small, slightly sclerotized plate on papillae anales. Ovipositor relatively short, about 0.20x length of T1-T7, papillae anales membranous (except for basal plates of posterior apophyses) or laterally lightly sclerotized.

Note about structure of socii. — The membranous concavity or fovea of the median groove that results from the fusion of the socii has, in most species of *Mimiella*, a characteristic, sparsely punctate appearance (Fig. 286). Under high magnification in differential interference contrast microscopy, these punctures appear to be very small orifices which remind of openings of glandular structures such as those found in the cephalic foveae of some eumenine wasps (Cumming and Leggett 1985). Some species of *Mimiella* however lack orifices and have a shallowly concave and markedly sclerotized median groove between the socii. Presence of granduliform structures associated with the socii may indicate relationships between *Mimiella* and *Commodes* but in the latter these structures have a very different aspect, suggesting that they may have been independently derived. Analogous structures are also found in members of the unrelated genus *Rhamphura*. The presence of markedly developed and variouly shaped or sculptured socii along with associated glanduliform structures in some genera suggest a secretory function for those "glands" and a disseminating function of the secretions of the "glands" for the socii.

Monophyly and relationships. — Monophyly of *Mimiella* is indicated by concavity with small punctures in the fused medial region of the socii and, possibly, by the shape of the aedeagus, which has a bulbous base. *Mimiella* is inferred to be closely related to *Aeciatus*.

Included species and generic diversity. — The following species are here transferred from *Scythris* (*sensu* Hodges *et al.* 1983) to *Mimiella*:

Mimiella divaricata (Braun, 1923a: 121), **new combination**; southwestern USA and Baja California (Mexico).

Mimiella oxyplecta (Meyrick, 1916: 14), **new combination**; Florida.

In addition I have examined specimens of 12 undescribed species from North America and México. The genus appears particularly well represented in California and Arizona, as suggested by the relative abundance of material collected there.

Geographical distribution. — Members of *Mimiella* are known only in the Nearctic region, with the great majority of species ranging in and parts of the southwestern United States and northern Mexico. At least one undescribed species extends as far north as southernmost British Columbia in the Great Basin desert. Except for *S. oxyplecta* Meyrick which was described from Florida, no species is known to occur east of central Texas.

Natural history. — Immature stages are unknown. The only known foodplant record is for a short series of an undescribed species from southern California which was reared from *Atriplex semibaccata* R. Br. (Chenopodiaceae). This is likely not the natural host however because it is a plant species naturalized from Australia. Adults of all species appear to be nocturnal.

4.15 *Oncoxystus* new genus

(Figs. 57-58, 67, 69-70, 106, 123, 289-292, 359-361, 377)

Type species. — *Oncoxystus longissimus* new species, by present designation. Type repository: UCB.

Derivation of generic name. — From the Greek *onkos* (m., = hook or barb) and *xyston* (n., = spear or shaft of a spear); given in reference to the shape of the aedeagus which resembles a long spear with a set of barbs. Gender: masculine.

Recognition. — In color and size specimens of *Oncoxystus* are similar to some *Commodes*, *Meniscotus*, *Mimiella* and *Serangites* but are more slender. They are distinguished from them and from all other Nearctic scythridids by features of other parts of the genitalia. In males (Figs. 289-290) the aedeagus is extraordinarily long, more than twice the length of the genitalia and almost as long as the entire abdomen, is ankylosed by a similarly elongate juxta and has a series of inwardly directed barbs in the apical portion, resembling a harpoon. In females (Figs. 360-361) sternum 8 is protruded into a linguiform plate (= sterigma), the bursa is bean-shaped and the wall of vestibulum between the accessory gland duct and the oviduct is very finely convoluted.

Description. — Habitus. Medium-large, very slender scythridids with narrow, almost parallel-sided dorsal profile.

Color. Ground color whitish or pale drab variously mixed with ochreous-grey or pale brown. Upper surface of forewing (Figs. 57-58) with ± distinct pattern of elongate, whitish spots on disc somewhat alternating with darker areas or irregular short streaks, and with ± distinct, small, dark pre-apical dot. Hindwing unicolorous, paler than forewing. No significant color difference between sexes.

Head (Figs. 67, 69-70, 106). Head and appendages as in *Commodes* except: eyes flatter, interocular index 0.86; antennal flagellum with 47 articles; labial palpi as in *Arotrura*, LP/HH = 2.10.

Thorax. Prothorax as in *Scythris* except: pronotum with antero-ventral markedly thickened; sternum with indistinct carina; furcal process very foreshortened, almost abutted to sternum (lateral aspect), ventral portion of prothorax thus appearing very antero-posteriorly compressed; ventro-lateral margin of sterno-pleural bridge broadly and regularly rounded.

Mesothorax as in *Scythris* except: epimeron with incomplete, somewhat indistinct trans-epimeral sulcus, connection with dorsal arm broad; upper sector of precoxal suture absent; lower sector of precoxal suture curved mediad; pre-episternum without transluscent zone (Fig. 123).

Metathorax as in *Scythris* except: metascutum with shallow lateral impression. Metascutellum with broadly and shallowly concave lateral margins. Metepimeron without trans-epimeral sulcus, moderately broad. Intercoxal lamella present, very thin and lightly sclerotized. Furcal apophysis low, arising subapically on furcal process, anterior projections broad, subtriangular, posterior projections comparatively short.

Legs as in *Scythris* except without additionnal pre-apical spine on tarsomeres.

Wings. Forewing lanceolate, broadest in middle, FL/FW = 4.8-5.0, slightly broader than hindwing, FW/HW = 1.1, apex acute, termen slightly sinuate. Hindwing lanceolate, HL/HW = 4.0-4.3, broadest in basal third, costa bulged in basal third, apex acute, termen slightly sinuate. Venation as in *Colinita* except as follow: forewing in some specimens with base of M2 subcontiguous to base of M3-CuA1 stalk. Retinaculum as in *Scythris* . Frenulum as in *Arotrura* . Frenum absent.

Male abdomen. T1-T2 suture singly margined, T2 anterior margin with distinct or indistinct medial membranous invagination or flap. T1 with indistinct, triangular sclerotized area in posterior half. T2-T7 membranous, with indistinct anterior margin. T8 (Fig. 292) markedly differentiated and sclerotized, extended above genitalia, somewhat spear-shaped in dorsal aspect with long, slender antero-lateral lobes extended inside abdomen to middle of T6, distal portion digitate, simple, straight. Intersegmental membrane T8-tegumen not modified nor sclerotized. S2 with apodemes about 0.15x length of sternum, venulae fine and much longer than apodemes, unscaled area between venulae with irregular, somewhat Y-shaped, ridge more sclerotized than surrounding, rest of S2 nearly membranous. S3-S8 lightly sclerotized, unmargined. S8 small, about half size of S7.

Male genitalia. As for type species.

Female abdomen. T1-T2 as in male. T1-T6 very slightly sclerotized, T3-T5 anteriorly margined, T6-T7 unmargined. T6 in anterior half slightly concave and with transverse wrinkles. T7 most sclerotized of terga, elongate-subconical, laterally sinuate, anteriorly more markedly sclerotized but not distinctly margined. S2 as in male. S3-S5 moderately sclerotized, S6-S7 more so. S3 elongate-rectangular, S4 rhomboid, S5-S6 transversely rectangular, S6 antero-medially with small, concave, wrinkled area. S7 (Fig. 359) ± elongate-rectangular, antero-laterally constricted with anterior margin strikingly developed as thick, slender flanges extended dorsally with apices abutted to antero-lateral angles of T7; posterior margin of S7 with protruded, medial, membranous lobe.

Female genitalia. As for type species.

Monophyly and relationships. — Monophyly of *Oncoxystus* is indicated by the strikingly elongate, harpoon-shaped aedeagus and juxta of males and by the linguiform sterigma and walls of the vestibulum with very fine convolutions of females. *Oncoxystus* and the following two genera, *Commodes* and *Serangites*, treated below, are inferred to form a monophyletic group on the basis of fused and dilated socii.

Included species and generic diversity. — The type species is the only known member of this new genus.

Geographical distribution. — Endemic to the arid parts of the southwestern Nearctic region.

Natural history. — Immature stages and foodplants are unknown. Adults are both diurnal and nocturnal.

4.15.1 *Oncoxystus longissimus* new species

(Figs. 57-58, 289-292, 359-361, 397, 416)

Type material. — HOLOTYPE, male, labelled: West Cove, San Clemente Island, Los Angeles Co., California, 21.iii.1972, J. Powell collector [two white, printed labels] (UCB). PARATYPES, 95 males, 45 females. ALLOTYPE, female, labelled same as holotype; genitalia on slide no. JFL-85-0312 (UCB). Twenty-one males, six females: same data as holotype; one female right wings on slide JFL-85-0427 (UCB). One male, four female: same data as holotype except for date, 31.iii.1972; genitalia of one male and one female respectively on slides no. JAP 3518 and JAP 3519 (UCB). Nine males, two females: same locality as holotype, 15.iv.1980, J. Powell & D. Faulkner (UCB). Nine males, three females: 2 mi. N Eel Point, San Clemente Island, Los Angeles Co., California, 11.iv.1980, J. Powell & D. Faulkner (UCB). Four males, one female: Seal Cove, Rock Wall Canyon area, San Clemente Island, Los Angeles Co., California, 14.iv.1980, J. Powell & D. Faulkner (UCB). Three males: West Coast, 2 mi. SW Wilson Cove, San Clemente Island, Los Angeles Co., California, 11-14.iv.1980, J. Powell (UCB). Nine males, three females: San Clemente Island, Los Angeles Co., California, [date].1939, L. Martin (Channel Islands Biological Survey); dates as follow: four males, one female, 2.iv.; two males, 4.iv.; one male, 22.xi.; two males, 1.xii.; one male, one female, 7.xii. (LACM). One male, ten females: Dutch Harbor area, San Nicolas Island, Ventura Co., California, 6.v.1978, J. Powell & J. Doyen (UCB). Three males: Beach area NE NAS Headquarter, San Nicolas Island, Ventura Co., California, 7.v.1978, J. Powell; one male genitalia on slide no. JAP 4223 (UCB). One female: San Nicolas Island, Ventura Co., California, 24.vii.1939, L. Martin (Channel Islands Biological Survey) (LACM). One male: Santa Barbara Island, Los Angeles Co., California, 28.v.1939, L. Martin (Channel Islands Biological Survey) (LACM). One male: Middle Canyon, 500 ft., Santa Catalina Island, Los Angeles Co., California, 1-3.v.1978, J.A. Chemsak (UCB). One female: Little Harbor, Santa Catalina Island, Los Angeles Co., California, 29.iv.1932, D. Meadows (LACM). Nineteen males, thirteen females: La Jolla, San Diego Co., California, [date].1963, [collector]; dates as follow: five males, five females, 17.vi; four males, six females, 18.vi; one male, 23.vi; three males, one female, 25.vi; one male, one female, 1.vii; one male, 8.vii; one male, 12.vii; one male, 22.vii; collectors as follow: J. Powell, 24 specimens; N.L. Griffin, two specimens; R.L. Langston, three specimens; P.D. Hurd, one specimen; (UCB). Four males: Laguna Beach, Orange Co., California, [date], O.C. Poling; dates as follow: one male, 15-30.xii.1924; one male, 1-15.i.1925; two males, 15-30.i.1925; one male genitalia on slide no. JFL-84-1082 (USNM). One male: Sierra Diablo, 6000 ft., 20 mi. NNW Van Horn, Culberson Co., Texas, 27.v.1973, R.W. Hodges; genitalia on slide no. JFL-84-1085 (USNM). One male: 5 km. S Bahía de los Angeles, Baja California Norte, Mexico, 27.xii.1978, R. Dietz & R. Clarke (UCB). Four males: 5 mi. E El Rosario, Baja California Norte, México, 19.iii.1972, J. Powell (UCB). Two males: 7 mi. SW La Paz, Baja California Sur, M´xico, 8.viii.1966, J. Powell (UCB). Two males: Ensenada Los Algonodes, 6 mi. W San Carlos (on Bahía San Francisco, west of Guaymas), Sonora, México, 22-23.iii.1972, J. Doyen (UCB).

Type locality. — West Cove, San Clemente Island, Los Angeles Co., California.

Condition of holotype. — Spread, pinned on minuten, double-mounted on polyporous block, in good condition.

Derivation of specific epithet. — From the Latin *longissimus* (= longest); given in reference to the extremely long aedeagus of male specimens.

Recognition. — As described in the generic diagnosis.

Description. — Size. Forewing length 6.8-8.5 mm (mean 7.6 mm); hindwing length 5.9-7.3 mm (mean 6.6 mm); wing expanse 14.8-18.4 mm (mean 16.5 mm) (15 specimens).

Head. Face and neck tufts in most specimens white or whitish, sparsely to moderately densely suffused with ochreous-drab or buff, in some specimens predominantly drab or pale olive-brown sparsely to moderately densely suffused with buff and whitish, with light iridescent metallic lustre. Haustellum base covered with white scales or white mixed with some drab. Labial palpi with article 1 white, articles 2 and 3 ventrally predominantly drab or pale olive-brown with sparse white scales, dorsally mostly white with sparse drab scales or with olive-brown suffusion, apical portion with white annulation in most specimens. Antenna with dorsal surface drab in most specimens, olive-brown in some specimens; scape and pedicel ventrally white, pecten of scape of white or mixture of white and drab, setiform scales.

Thorax. Collar and dorsal surface of mesothorax colored as face; sparse scales of metathorax white. Ventral surface lustrous white, in some specimens with sparse mixture of golden drab or greyish scales. Legs predominantly white with sparse drab suffusion and with tarsi slightly darker, golden drab; or outer side with about even mixture of white-drab and plae olive-brown on femora and tibiae, tarsi mostly drab, grey or pale olive-brown with light metallic golden lustre.

Wings. Forewing upper surface with very light metallic lustre; in predominantly pale specimens (Fig. 58), surface with ground color whitish variously suffused with drab and olive-brown, suffusion forming ± indistinct pattern of fine longitudinal streaks as follows: proximal half with oblique, somewhat V-shaped or zigzagged dark streak with pointed part directed apically, in some specimens with two or three very fine linear streaks, some extended to termen or end of cell, in most specimens with small dark dot at end of cell; in predominantly dark specimens (Fig. 57), ground color of upper surface grey, grey-brown or grey-olive-brown variously suffused with white, buff and pale drab, with ± indistinct pattern of white or dark longitudinal streaks similar to that of pale specimens, in some specimens pattern of proximal half diffusely mottled, all specimens with small dark dot at end of cell; ventral surface uniformly grey-drab or ochreous-drab with same lustre as upper surface; cilia ochreous-drab, termen darker, drab in pale specimens, pale olive-brown in dark specimens. Hindwing upper surface with proximal half or two-thirds pale drab or whitish drab, distal third of half darker grey-drab, with light metallic lustre; ventral surface ochreous or grey-drab, with same lustre as upper surface; cilia ochreous-white, in apical quarter or third darker, pale drab.

Abdomen. In males, dorsal surface in most specimens uniformly whitish drab or pale drab, in some dark specimens terga drab-grey or pale olive-brown with posterior transverse band of paler drab or drab and buff; anal brush prominent, whitish or ochreous; scales of projected part of T8 narrowly lanceolate and contrasting with short, oval scales of anterior portion of tergum; ventral surface pale colored as dorsal surface with sparse pale olive-brown or brown suffusion; in specimens with terga with pale posterior margin, pleura ochreous or cream-color and ventral surface predominantly olive-brown with drab and white suffusion, with posterior margin cream-color, apical portion cream-color or ochreous. In females, dorsal surface uniformly greyish-white, cream-color or ochreous-white, with silvery or golden metallic lustre in most specimens, dull in some specimens; posterior margin of T7 fringed with long, lanceolate, pale yellow scales contrasting with short, suboval anterior scales; ventral surface more darkly colored than dorsal surface, with various mixture of olive-brown, drab, ochreous and white, apical portion of S8 pale yellow.

Male genitalia (Figs. 289-292). Slender, symmetrical. T8 (Fig. 292) slender, anterior lobes very slender, in form of elongate U in dorsal aspect; ventro-medial arms narrow bands attached subbasally to, and shorter than, anterior lobes, and extended parallel and close to margin of anterior lobes (thus difficult to distinguish from the latter unless T8 is rotated); distal projection digitate, straight or asymmetrically curved, extended beyond apex of valvae, with elongate, razor-thin, ventral crest, slightly bent ventrally. Tegumen nearly completely divided into two halves united dorso-medially by narrow bridge (Fig. 290), U-shaped and broadly open in dorsal aspect, anterior margin of bridge concave at point of attachment of socii, each half very narrow in lateral aspect with posterior margin straight, obliquely oriented; pedunculus slightly constricted, curved inwardly, articulated to dorso-inner wall of base of valva. Uncus absent. Socii developed, sclerotized, about 0.40x length of genitalia (exclusive of aedeagus-juxta), extended to about middle of valvae, fused together basally; in dorsal aspect (Fig. 290) basal half laterally dilated, explanate, medially with anteriorly directed setose lobe, distal half narrow, apex hooked; in lateral aspect (Fig. 289) medial lobe ventrally prominent, distal half ventrally densely setose with stiff, erect, anteriorly directed setae, dorsally with dense medial patch of anteriorly directed setae. Gnathos (Fig. 289) thin, of delicate appearance, wishbone-shaped, paired basal arms arising from base of socii, distal arm in lateral aspect somewhat sinuate or sigmoid, in some specimens with apical portion abruptly bent dorsad and hook-like. Vinculum (Fig. 291) reduced to narrow, U- or V-shaped, margin-like band protruded caudally between and fused to base oof valvae. Valvae (Figs. 289-291) subsymmetrical, very slender, basally fused to each other, base deeply emarginate, emargination extended to about half of valva length, inner fused wall anteriorly protruded into long, lanceolate and dorsally trough-like juxta extended anteriorly beyond base of valvae (Fig. 291); distal half of valva simple, tapered, costa densely setose, in lateral aspect costa with medial emargination. Diaphragma (Figs. 289-290) extended into abdomen around long aedeagus and juxta; upper diaphragma between anterior margin of tegumen and uncus with dorsally convex, moderately sclerotized, dome-like plate covering distal portion of aedeagus. Aedeagus (Figs. 289-290) extraordinarily long, longer than rest of genitalia, about length of T1-T5 combined, extended cephalad into abdomen to base of T3, harpoon-like with shaft almost straight, thin, and distal portion with series of 7-8 anteriorly recurved spines, apex pointed and slightly upcurved; phallotreme indistinct, possibly apical or subapical (ductus ejaculatorius visible to about level of spines then blurred or indistinct, even in differential interference contrast microscopy); bulbus ejaculatorius small, subcrescentic.

Female genitalia (Figs. 360-361). T8 semi-membranous, elongate-rectangular, posterior margin lined with one or two irregular rows of fine setae, anterior half with indistinct longitudinal carina. S8 (Fig. 360) with markedly sclerotized, oval-linguiform plate forming sterigma; anterior third of plate shallowly depressed, concave, with short lateral ridges, anterior margin of sterigma broadly and shallowly emarginate with anterior angles produced into short apodemes;

intersegmental membrane S7-S8 attached to posterior edge of concave area and extended caudally over distal two-thirds of linguiform plate, S7 thus extended over most of sterigma. Ostium relatively large, 2-3x diameter of anterior apophyses, medially on posterior edge or concave area and covered by intersegmental membrane S7-S8. Ductus bursae (Fig. 360) with proximal quarter slightly sclerotized and widened, with shallow, transverse constrictions or wrinkles, distal three-quarters thin, very fine, membranous, ribbon-like, inception dorso-medial on bursa. Corpus bursae (Fig. 397) ovoid or somewhat bean-shaped, membrane of wall very flimsy. Ductus seminalis (Fig. 397) with point of origin ventro-medial on bursa, opposite to point of inception of ductus bursae, duct very narrow between bursa and ductus spermathecae, distal portion between accessory gland duct and vagina markedly dilated and of striking papillate appearance (Fig. 397) from dense, fine convolutions of membrane surface (Fig. 361). Spermatheca (Fig. 397) bulbous with tapered distal portion, distal half of ductus spermathecae finely coiled. Anterior apophyses straight, divergent, about twice length of T8, prolonged laterally over half length of T8. Posterior apophyses thinner, and slightly longer than anterior ones, basal portion inside papillae anales very fine, acuminate at their origin. Ovipositor relatively short, about 0.20x length of T1-T7; papillae anales slender, about half length of ovipositor, membranous, delicate, slightly dilated, with few scattered , short and very fine setae dorsally and apically, ventral side asetose.

Variation. — In color of upper surface of the forewings, specimens of *O. longissimus* vary from pale, with predominantly whitish, dirty white or pale drab ground color with indistinct brownish streaks (Fig. 58), to darker with predominantly grey or pale olive-brown ground color suffused with whitish and pale drab and with streaks and indistinct fasciae of that same pale color (Fig. 57). In most specimens examined, the small dark dot at the apex of cell is distinct, or indistinct. In some darker specimens, the pale fasciae and dark streaks give the appearance of a diffusely mottled pattern in the proximal half the the forewings. The face and dorsal surface of the mesothorax are correspondingly toned in color to the predominant ground color of the forewings. There is no discrete separation of pale and dark forms, as there are series of individuals displaying the whole range of intermediate coloration between predominantly dark, grey-olive-brown and predominantly whitish. Specimens of every coloration have been collected throughout the known flight period so that no seasonal segregation of color forms is apparent. No significant variation was observed in male or female genitalia (four and three preparations examined, respectively).

Geographical distribution and period of flight. — Known from southern California, where it occurs on the southern Channel Islands and on adjacent coastal mainland, Baja California, southern New Mexico, westernmost Texas and the Mexican provinces of Sonora and Nayarit (a single specimen from San Blas, Nayarit province, not included in type series), the latter being the southernmost record (Fig. 416). Adults have been collected in all months of the year except February, September and October, with most records being from March to July. Specimens have been collected during daytime on flowers (Powell and Hogue 1978, color plate 9c; Powell, pers. comm. 1987), and at blacklight.

Hostplant. — Unknown.

4.16 *Commodes* new genus

(Figs. 62, 127, 294-298, 365-367, 398)

Type species. — *Commodes radulatus* new species, by present designation. Type repository: UCB.

Derivation of generic name. — From the Greek *komma* (= a mark of punctuation), and *odes* (suffix denoting likeness); referring to the expanded, sclerotized intersegmental membrane between tergum 8 and the tegumen of males, which resembles a comma in lateral aspect. Gender: masculine.

Recognition. — In external appearance, members of *Commodes* resemble paler specimens of species of *Colinita, Hyalinixys, Meniscotus* and *Serangites*. They are readily distinguished from them and other scythridids by characters of male genitalia: presence inside the tegumen of a membranous, serpentine, glanduliform structure with an alutaceous surface (a unique and best distinguishing feature), a lobate or comma-like sclerotized intersegmental membrane extended above the base of socii, markedly sculptured socii, fused and basally very deeply emarginate, valvae with a markedly prominent cucullar lobe and very short distal portion (Figs. 294-297). As far as is known, females of *C. radulatus* are distinctive in having a crenulate, transverse, sclerotized band anterior to the ostium and a lobate sterigma which is lip-like in lateral aspect (Figs. 366-367). Female genitalia are known only for the type species and thus cannot be used at present to aid in recognition of members of other species of the genus.

Description. — Description of skeletal characters of head and thorax is based on examination of specimens of an undescribed species.

Habitus. Slender or slightly stout, medium-large to large scythridids.

Color. Ground color white, greyish or drab, variously suffused with tones of brown, drab, clay-color or grey. Body, except wings, unicolorous, or if more than one color, then ground color uniformly suffused without distinct patterns or stripes in most species. Forewings dorsally with indistinct pattern of fine, irregular, zigzagged or interrupted streaks, or finely mottled, or with few irregular, diffuse fasciae or spots (Fig. 62); ventral surface unicolorous, but with diffuse darker shading in some species. Hindwing unicolorous, paler than forewings, greyish or whitish. No significant color differences between sexes (female only known for type species).

Head. Face about as wide as, or slightly wider than, high, in profile convex and narrower than high. Scales as in *Scythris* . Eyes very large, interocular index 0.91, about as in *Arotrura* . Fronto-clypeal ridge slightly convex. Transfrontal sulcus distinctly marked, not impressed. Gena narrow. Pilifers prominent below fronto-clypeal ridge. Occipital ridge rounded; occipital sulcus absent or barely suggested. Post-occipital region flat in profile. Temporal sulcus indistinctly marked. Postgena in lateral aspect narrow. Ocelli absent. Haustellum as in *Arotrura* . Antenna as in *Arotrura* , except flagellum with 43-47 articles. Maxillary palpi as in *Arotrura* . Labial palpi as in *Arotrura*, LP/HH = 1.93.

Thorax. Prothorax as in *Scythris* except: pronotum with antero-ventral margin markedly thickened, carina obsolete; sternum with indistinct carina; furcal process foreshortened, somewhat as in *Oncoxysus* but with distinct protuberance, without intercoxal lamella; ventro-lateral margin of sterno-pleural bridge broadly and regularly rounded.

Mesothorax (Fig. 127) as in *Arotrura* .

Metathorax as in *Scythris* except: metascutum with marked lateral impression. Metascutellum subquadrate-trapezoid, anterior margin convex, anterior angles prominent, sides shallowly concave. Metepimeron without trans-epimeral sulcus. Furcal apophysis as in *Arotrura* .

Legs as in *Scythris* except without additionnal pre-apical spine on tarsomeres.

Wings. Forewing lanceolate, broadest in middle, FL/FW = 4.6-5.1, as broad as, or slightly broader than, hindwing, FW/HW = 1.0-1.2, apex pointed, not constricted, termen straight or slightly sinuate. Hindwing lanceolate, HL/HW = 3.8-4.6, broadest in basal third, costa bulged in basal third, apex acute, termen slightly sinuate or straight. Venation as in *Colinita* except as follow: forewing with M2 separate from stalked M3-CuA1, stalk of M3-CuA1 distinctly developed or obsolete. Retinaculum as in *Scythris* . Frenulum as in *Arotrura* . Frenum absent.

Male abdomen. T1-T2 suture doubly margined, in some species margins obsolete, indistinct medially. T2-T7 membranous, T3-T6 with anterior margin. T8 markedly differentiated and sclerotized, ventro-medially fused to markedly sclerotized intersegmental membrane T8-tegumen, extended above genitalia, elongate, subtriangular or subtrapezoid, in some species asymmetrical, distally tapered, anteriorly with long, slender or broad lobes extended inside abdomen to level of anterior margin of T7 (Fig. 298), lateral margin produced ventrally near base of anterior lobes, process fused along latero-posterior margin of tegumen; apical portion slightly to markedly asymmetrical, variously bi- (Fig. 298), tri-, or quadri-lobate, or spatulate and with lateral digitate projections. Intersegmental membrane T8-tegumen medially produced into downcurved, lobate process projected beyond medio-posterior margin of tegumen above base of socii and gnathos (Figs. 294-295), and about 0.30x length of genitalia, in several species base of lobe expanded into crested dome somewhat as in *Arotrura* and/or with lateral flanges extended ventrally to brace base of socii-gnathos. S2 as in *Arotrura* except venulae distinct, fine in most species. S3-S8 lightly sclerotized, in some species S5-S7 medially divided by longitudinal membranous gap. S8 small, about 0.25x size of S7.

Male genitalia (Figs. 294-297). Large relative to abdomen, mostly symmetrical, markedly sculptured and complex in appearance. Tegumen markedly convex, greatly expanded laterally, transversely dome-shaped or arch-shaped; anterior margin dorso-medially deeply V- or U-emarginate (Fig. 295), emargination narrow or wide, or tegumen completely divided into two halves in some species, with dorso-medial sulcus inwardly expanded into a ridge; antero-lateral portion inwardly reflexed, front end of genitalia partly closed; latero-posterior margin evenly rounded, or sinuate, or slightly concave, or medially with digitate projection oriented ventro-caudally; pedunculi indistinct or moderately developed; space enclosed by tegumen with elongate, ± serpentine, gland-like membranous structure with alutaceous surface, orifice indistinct, very small, situated between socii near inner side of right socius. Intersegmental membrane between T8 and tegumen markedly sclerotized and modified, medio-caudally expanded as down-curved digitate (Figs. 294-295) or blade-like process above socii, process medio-anteriorly crested in one species, in some species process latero-ventrally with digitate lobes bracing base of socii-gnathos. Uncus absent. Base of socii-gnathos fused medially to caudal margin of tegumen, in most species not recessed under that margin (Fig. 295), in few species recessed; surface with fine, granular microsculpture. Socii symmetrical, as two long, highly ornate parallel arms extended to half or to nearly apex of valvae; base of arms fused to caudal margin of tegumen in most species, but in some species line of fusion recessed inside tegumen to level of anterior margin (with caudal margin of tegumen apparently medially invaginated); arms basally contiguous (Fig. 295) or separate (the latter in species with divided tegumen), sinuate, ridged (Figs. 294-295) or dorsally crenate, slightly to markedly bent; proximal portion with dorsal, variously expanded projection; medially with anteriorly-directed spiniform or lobate, dorsal projection (Fig. 294); distal two-thirds dilated, blade-like, digitate or subsecuriform, scatteringly to densely setose ventrally. Gnathos (Fig. 294) wish-bone-shaped, basal arms attached at about one third length of socii on outer side of latter; medio-distal arm narrow or wider than basal arms, apically hooked, shorter or subequal in length to basal arms, straight, curved on one side or bent upward. Vinculum (Fig. 296) markedly reduced, insconspicuous, fused to ventral margin of valvae base and distinguished only as narrow rim delineated by line of fusion. Valvae with base fused ventrally by transverse bridge and emarginate far caudally to about three-quarters of valvae length (so that fusion appears situated in distal portion of valvae) (Fig. 296); basalmost portion dorsally twisted to form socket articulated onto pedunculus; valvae markedly sculptured and ornamented, symmetrical or slightly asymmetrical (Figs. 294-295); inner margin medio-dorsally expanded across fusion bridge, elevated and produced as blade-like, digitate, lobate or scythe-shaped projection; medio-ventrally expanded cephalad into pedunculate plate embedded into membrane of fultura inferior and extended to base of aedeagus in some species; costa with large dorsal, variously shaped cucullar lobe (Fig. 295), somewhat anvil-like in general appearance with most dorsal portion scatteringly to moderately setose, with smaller accessory lobes in some species; apical portion of valvae digitate or spatulate, short (about one-quarter length of entire valvae), slightly to markedly upcurved, glabrous to densely setose on dorsal surface. Diaphragma membranous, but with various sclerotized plates around aedeagus (described below under "juxta"); in some species with small lateral sclerite below and anterior to base of gnathos. Juxta of uncertain origin (term used here to refer to sclerotizations surrounding and/or attached to and ankylosing aedeagus); sclerites asymmetrical in shape and position (Figs. 294, 296); in most species with two irregularly shaped sclerites dorso-laterad of aedeagus and third, less clearly defined plate ventro-laterad on left side of aedeagus; plates fused together near aedeagus base and to base of aedeagus, in some species expanded dorsad of aedeagus as semiparabolic structure, or ventro-posteriorly into plate fused to or approximating medio-ventral projection of valvae; surface of some plates rugulose or spinulose in some species (*e.g. C. radulatus*) (Fig. 296). Aedeagus deeply recessed under tegumen, small, moderately to markedly asymmetrical in shape: narrowly tubular and regularly upcurved with lobiform base, or tubular and sigmoid with laterally dilated base, or with broad, subrectangular, flat base with "windows" (areas of light sclerotization) and narrow, sigmoid apex, or with spiniform process on right side of base (Fig. 296); bulbus ejaculatorius as small, membranous flap.

Female abdomen. Same as for type species, which is the only species of the genus whose females are known. T1-T6 as in male. T7 most sclerotized of terga, quadrate with rounded angles. S2 as in male, venulae well developed. S2-S6 lightly sclerotized, unmargined. S7 most sclerotized of sterna, subdivided into three sternites (Fig. 365), medial sternite largest, quadrate, laterally sinuate, posterior margin with small, barely protruded, membranous lobe, lateral sternites subtriangular.

Female genitalia. Same as for type species, the only member of the genus whose females are known.

Monophyly and relationships. — Monophyly of *Commodes* is indicated by presence, inside the tegumen, of a membranous, gland-like structure which opens between the socii, and by the sclerotized intersegmental membrane T8-tegumen which forms a curved, digitate lobe above base of the socii. Presence of the single glanduliform structure is unique to the genus and hypothesized to be autapomorphic. *Commodes* is related to *Oncoxystus* and the following genus based on apomorphic features of the socii (see under *Oncoxystus*).

Included species and generic diversity. — The type species is the only described member of this new genus. In addition, I have examined specimens of nine undescribed species from southwestern USA and Baja California (México).

Geographical distribution. — Known only from the Nearctic region (southcentral and southwestern United States and Baja California, México). Undescribed species occur in southern Texas, Arizona, southern Nevada, southern California and Baja California (México).

Natural history. — Hostplants and immature stages are unknown. Collecting data on specimen labels of undescribed species indicate that adults of most species are probably nocturnal. However specimens of one undescribed species from southern California were collected at flowers of *Haplopappus Cooperi* (Gray) Hall (Compositae), presumably during day time.

4.16.1 *Commodes radulatus* new species

(Figs. 62, 294-298, 365-367, 398, 416)

Type material. — HOLOTYPE, male, labelled: Laguna Atascosa, Cameron Co., Texas, 11.xi.1979, A. & M.E. Blanchard [label white, printed, except date handwritten] (USNM). PARATYPES, 2 males, 1 female. ALLOTYPE, female, labelled same as holotype except for date: 1.iv.78 (USNM); genitalia on slide no. JFL-85-0319. Two males, same data as holotype, one with genitalia and right wings on slide no. JFL-84-0043 (USNM).

Type locality. — Laguna Atascosa, Cameron Co., Texas.

Condition of holotype. — Spread, pinned on minuten, double-mounted on polyporous block, abdomen undissected. In good condition.

Derivation of specific epithet. — From the Latin *radula* (= scraper) and *-atus* (= having); given in reference to the denticulate-serrate lateral sclerotizations of the diaphragma which surround the aedeagus and remind of scrapers.

Recognition. — Specimens of *C. radulatus* are distinguished from those of somewhat similar-looking scythridids of other genera (as mentioned in the generic diagnosis) by the dark, rather large and somewhat diffuse patches and the lack of longitudinal or oblique streaks on the upper surface of forewings. Members of other genera with similar forewing patches usually also have some dark or pale, fine streaks on the disc. Separation from other similarly colored *Commodes* must be based on features of the male genitalia (female genitalia are unknown in all other undescribed species of the genus). Males of *C. radulatus* are easily recognized by the rugulose-spinulose surface of the sclerites of the juxta (attached laterally to the aedeagus) (Figs. 294, 296), the lack of lateral flanges on the digitate process of the intersegmental membrane T8-tegumen (Fig. 294) and the subtriangular, apically sub-bilobate distal projection of T8 (Fig. 298).

Description. — Size. Forewing length 7.0-7.8 mm (mean = 7.5); hindwing length 5.8-7.0 mm (mean = 6.4); wing expanse 15.2-17.2 mm (mean = 16.4) (4 specimens).

Head. Face white evenly mixed with drab and with light metallic lustre, neck tufts white. Haustellum base covered with mixture of drab and white scales. Antenna: scape dorsally colored as face, ventrally white, pecten of evenly mixed white and drab scales; pedicel and flagellum brownish-drab with light metallic lustre. Maxillary palpi whitish or pale drab. Labial palpi extended to vertex of to base of antennae; article 1 entirely white or white mixed with drab; articles 2 and 3 white with broad, drab or pale olive-brown, medial annulation.

Thorax. Dorsal surface colored as face, or with mesoscutum predominantly olive-brown with latero-posterior portion white; mesoscutellum olive-brown with few drab and white scales. Ventral surface lustrous white. Legs. Foreleg with outer surface olive-brown with scattered white or pale suffusion, apex of tibia with narrow, apical, white annulation, tarsus with light golden metallic lustre; inner surface white. Midleg colored as foreleg but with denser white suffusion. Hindleg predominantly white with scattered drab suffusion, tarsus colored as that of midleg.

Wings. Forewing upper surface with very light metallic lustre, predominantly white with drab and buff suffusion, or drab with white and buff suffusion, distal third between costa and fold almost uniformly drab; disc with dark greyish-brown or blackish patches or spots as follow (Fig. 62): two larger patches in proximal half between fold and hind margin, one small spot in distal third at apex of cell, in some specimens one or two additional small spots in proximal third just above fold; in some specimens with some buff scales between larger patches; ventral surface with same metallic lustre as upper surface, olive-brown or smokey-grey, with some drab, in some specimens margins or apex pale drab or cream-white; cilia pale drab or ochreous. Hindwing upper and ventral surfaces uniformly pale drab, with light golden metallic lustre; cilia colored as those of forewing.

Abdomen. In male, dorsal surface entirely white, lustrous; ventral surface predominantly white mixed with some drab; pleural hair pencils of 8th segment prominent, white; scales of lateral portions of T8 elongate, hair-like as those of hair pencils. Color of abdomen of single known female not noted prior to dissection.

Male genitalia (Figs. 294-298). T8 (Fig. 298) with anterior slender lobes rod-like, ventro-lateral processes about half length of anterior lobes, incurved; distal, projected portion of T8 elongate-subtriangular, extended to near apex of socii, apex slightly constricted, sub-bilobate, lateral margins with few fine setae. Tegumen (Fig. 294) broadly triangular in lateral aspect, not completely divided dorsally, with antero-dorsal emargination V-shaped and about two-thirds of tegumen length; posterior margin dorso-medially produced into subtriangular plate, fused with base of socii-gnathos complex; inner glanduliform sac large, conspicuous. Lobe of intersegmental membrane T8-tegumen (Fig. 294) digitiform, slightly downcurved, extended to about level of middle of socii, without lateral flanges. Socii long, extended almost to apex of valvae, basal plate dorsally concave, not recessed cephalad under tegumen; socii medially contiguous (Fig. 295), not fused, with small lateral notch and small dorsal lobe near base, distal two-thirds slightly divergent, subsecuriform. Gnathos (Fig. 294) with distal arm twisted, dorsally bent. Valvae: projection of inner margin in lateral aspect ridge-like, curved caudad, terminated in digitate lobe, with few dorsal short setae; outer wall of valva markedly concave; cucullar lobes slightly asymmetrical, with accessory lobe on inner side; apical projection of valva slightly upcurved, digitate, with few, very short setae at tip. Diaphragma with paired, small sclerotized plates anterior of base of gnathos arms. Juxta-aedeagus complex: base of aedeagus broadly oval, funnel-shaped, ankylosed, distal portion very narrowly tubular, with large lateral spiniform process on right side (giving the appearance of a bifurcate aedeagus) (Figs. 295-296); juxta (?) as pair of asymmetrical, warped, sclerotized plates arising latero-dorsally from base of aedeagus and extended posteriorly, left plate partly curved aedeagus, surface of plates rugulose-spinulose (Figs. 294, 296).

Female genitalia. T8 medially with moderately sclerotized triangular area lined posteriorly with nine or ten fine setae. S8 (Fig. 366) markedly sclerotized, U-shaped, broad with emarginate portion anterior; surface smooth, asetose; postero-laterally with small, slightly sclerotized plate with eight or nine fine setae. Sterigma (Fig. 366) on intersegmental membrane S7-S8, protruded in lateral aspect, ± lip-like with sclerotized, crenulate, transverse band anterior to ostium and membranous, semi-rigid, subtriangular protrusion overlapping base of S8. Ostium small, mediad on sterigma, closer to posterior margin of S7 than of S8, in plane perpendicular to that of sternum (Fig. 367). Ductus bursae with markedly sclerotized, very short antrum (Fig. 366), otherwise membranous; proximal 1/4 just cephalad of antrum markedly dilated; inception laterally on broad anterior third of bursa. Corpus bursae (Fig. 398) elongate, with anterior third bulbous, distal two-thirds narrower, cylindrical, opened directly into vestibulum of vagina; ductus seminalis very broad, indistinguishable from corpus bursae. Spermatheca (Fig. 398) ellipsoid-ovoid, anterior tapered portion bent at right angle, duct finely coiled. Anterior apophyses thin, straight, divergent, base attached medially on dorsal surface of T8 and expanded on each side of triangular sclerite. Posterior apophyses thin, straight, about 1.5x length of anterior apophyses. Ovipositor relatively short, subequal to length of segment 6+7 (about 0.25x length of T1-T7); papillae anales very lightly sclerotized (or melanized), ± parallel-sided.

Variation. — No significant variation in external features was observed in the few specimens examined. Variation in male genitalia was not studied, that in female genitalia is unknown.

Geographical distribution and period of flight. — Known only from the type locality in southernmost Texas (Fig. 416). Specimens of the type series have been collected in early April and mid-November, suggesting that adults occur at least at the onset and end of the wet winter season. The moths have been collected at light.

Hostplant. — Unknown.

4.17 *Serangites* new genus

(Figs. 63-64, 109, 128, 165-166, 299-302, 368-371, 400)

Type species. — *Serangites powelli* new species, by present designation. Type repository: UCB.

Derivation of generic name. — From the Greek *seranx* (f., = cave) and *-ites* (Latin suffix denoting a place); given in reference to the deep inpocketing of the diaphragma of male genitalia. Gender: masculine.

Recognition. — In color and size members of *Serangites* are similar to specimens of *Colinita* , *Commodes* , *Meniscotus* , *Mimiella* and *Oncoxystus* , but are easily distinguished by features of the genitalia. In males the greatly expanded, hood-shaped tergum 8 is distally spatulate and dorsally bears a subapical or apical patch of stiff, erect setae (Fig. 302), the intersegmental membrane between T8 and the tegumen forms a broad, convex hood extended over one half to two-thirds of the genitalia, the socii are very elongate, extended to two-thirds the length of the valvae, the proximal paired arms of the gnathos are fused along the basal half or two-thirds of the socii before diverging from the latter, the diaphragma is deeply inpocketed, with the aedeagus appearing hanged from the dorsal wall of the diaphragma (Figs. 299-300). In females, sternum 8 has a series of oblique, transverse, or sublongitudinal sclerotized ridges anterior to the ostium (Fig. 371), and sternum 6 has a variously developed and shaped antero-medial fovea (Figs. 369-370).

Description. — Description of skeletal characters of head and thorax is based on examination of specimens of three undescribed species.

Habitus. Medium to very large, moderately stout scythridids.

Color. Pale with ground color ivory-white, white, ochreous, drab or pale grey; or dark with ground color olive-brown. Upper surface of forewing with cell pattern of alternating dark and pale short streaks or elongate spots with somewhat tessellate or variegated appearance, and rest of wing surface variously suffused with dark scales in predominantly pale specimens, or with dark scales in predominantly dark specimens. In some species forewing with broad, ill-defined, pale plical streak, or wing surface almost uniformly dark. In palest specimens, most of body white or ivory-white, upper surface of forewing with scattered, indistinct spots or short streaks. Hindwing unicolorous, in most species paler than forewing, in few species (*e.g. S. powelli*) as dark as forewing. Abdomen predominantly unicolorous. No significant color difference between sexes.

Head (Fig. 109). Face about as wide as high, in profile ± evenly convex, narrowed orbroadly rounded toward vertex. Scales as in *Scythris* . Eyes very large and bulbous, interocular index 0.91-0.96, or medium and moderately convex with interocular index = 0.56; ventral margin markedly extended below fronto-clypeal ridge, or not extended below ridge, suborbicular in outline. Fronto-clypeal ridge straight, slightly convex, or markedly convex and ventrally protruded. Transfrontal sulcus distinctly marked. Gena narrow, antero-ventral margin deeply concave. Pilifers prominent below fronto-clypeal ridge, or mostly hidden by ridge. Occipital ridge angulate or almost rounded; occipital sulcus absent. Post-occipital region ± flat in profile. Temporal sulcus moderately or markedly delineated, slightly impressed. Postgena in lateral aspect narrow. Ocelli absent. Haustellum as in *Arotrura* . Antenna as in *Arotrura* , except scape with sparse pecten of 5-6 scales near base or with dense pecten of 12-15 scales extended over proximal half; flagellum with 34-51 articles. Maxillary palpi as in *Arotrura* . Labial palpi as in *Arotrura*, in some species very long, LP/HH = 2.08-2.56, article 2 about 1.75-2.00x length of article 1.

Thorax. Prothorax as in *Scythris* except: hind margin of furca just below apophysis in some species straight, in other species markedly sinuate and lined with additional outer lamina;

sternum with short but distinct carina; furcal process with intercoxal lamella developed, crested; ventro-lateral margin of sterno-pleural bridge broadly and regularly rounded.

Mesothorax as in *Scythris* except: epimeron with marked, or with incomplete and indistinct, trans-epimeral sulcus; upper sector of precoxal suture absent (Fig. 128); lower sector of precoxal suture curved mediad; pre-episternum without transluscent zone; margino-pleural abbreviated or indistinctly extended across half width of katepisternum.

Metathorax as in *Scythris* except: metascutum with distinct or indistinct lateral impression. Metascutellum rectangular, anterior margin sinuate or straight, lateral margins with short, abrupt sinuation or broadly and shallowly concave, anterior angles very prominent or not, median carina present or absent, hind margin V-emarginate. Metepimeron without trans-epimeral sulcus, distinct or very slightly sclerotized and indistinct. Intercoxal lamella short, reduced. Furcal apophysis arising at anterior apex of furcal process, anterior projection subtriangular, or very high and blade-like with posterior projection thin, acuminate and as short as anterior one.

Legs as in *Scythris* except without additionnal pre-apical spine on tarsomeres.

Wings. Forewing lanceolate, broadest in middle, FL/FW = 4.1-5.3, as broad as, or slightly broader than, hindwing, FW/HW = 1.0-1.1, apex acute, termen sinuate. Hindwing lanceolate, HL/HW = 3.7-4.5, broadest in basal third, costa bulged in basal third, apex acute or pointed, termen straight or sinuate. Venation as in *Colinita* except as follow: forewing with M3-CuA1 forked, stalked, or connate (Fig. 165) and obsolete; hindwing with M2 and M3 separate and stalked, or connate (Fig. 166). Retinaculum as in *Scythris* . Frenulum as in *Arotrura* except in females with one bristle shorter and much thinner than other bristle. Frenum absent.

Male abdomen. T1-T2 suture distinctly doubly margined, or with T1 posterior margin obsolete, indistinct and T2 margin medially invaginated, in some species T1 posterior margin lacking and suture zone very broad and rather darkly melanized with latero-posterior angles of T1 margin prominent. In some species triangular zclerotized area of T1 medial, rather broadly separated from posterior margin by membranous gap. T2-T7 membranous to moderately sclerotized, anteriorly margined, in some species sclerotized area of T5-T6 reduced to small, medial, narrow patch. T8 strikingly differentiated and markedly sclerotized, ventro-medially fused to heavily sclerotized intersegmental membrane T8-tegumen, extended above genitalia, very elongate, hood-like, with long, slender, antero-lateral lobes extended over latero-dorsal portions of tegumen and inside abdomen to level of anterior margin of T7 or of T6, and with antero-ventral, very slender, thin arms fused alongside lateral margin of intersegmental membrane T8-tegumen (Fig. 302); distal portion of tergum spatulate, apex dorsally covered with dense, erect, short setae (Fig. 302) or ventrally with pair of tight clusters of short, stiff, non-deciduous scales. Pleural lobes developed, prominent. Intersegmental membrane T8-tegumen strikingly enlarged and sclerotized, hood-shaped, markedly convex, conical in dorsal aspect, relatively long with portion projected beyond tegumen and covering base of socii, gnathos and valvae about 0.40-0.60x length of genitalia (Fig. 299), latero-ventrally expanded almost to tegumen-valvae articulations. S2 in most species with well developed apodemes about 0.15-0.20x length of sternum, in few species apodemes very short, stubby, less than 0.10x length of sternum; in some species venulae distinctly developed and about 0.50x length of sternum, in several species venulae indistinct, as diffuse, lightly sclerotized bands; unscaled area medially raised, posterior half of sternum lightly and unevenly sclerotized. S3-S6 slightly to moderately sclerotized, more so than corresponding terga, unmargined. S5 or S6 medially membranous, divided into two sternites, S7-S8 membranous, S8 elongate-conical or linguiform.

Male genitalia (Figs. 299-301). Genitalia huge in proportion to rest of abdomen, 0.50-0.80x length of T1-T7, symmetrical, in dorsal aspect (Fig. 300) very elongate and narrow, 2.5-3.0x as long as widest point. Tegumen completely divided into two broad lateral lobes by deep, narrow or vey narrow, U-shaped anterior emargination (Fig. 300), joined dorso-medially by transverse bridge formed by fused base of 10th segment (socii-gnathos), rigidity of structure provided by intersegmental membrane T8-tegumen overlapping most of, and tightly appressed to, tegumen halves; in lateral aspect (Fig. 299) each half higher than wide, extended vertically above base of valvae, triangular in outline with broadly rounded angles, anterior margin thickened, narrowly and slightly inflexed, concave with appearance of dorsalmost part of tegumen anteriorly protruded, posterior margin straight; peduncului little differentiated in outline from rest of lobe, with markedly thickened apex articulated into socket of outer wall of valva short distance caudad of anterior apex of valva. Segment 10 (socii and gnathos) strikingly elongate, basal part as pair of narrowly elongate, flat, fused or subcontiguous plates (dorsal aspect) with surface partly or entirely rugulose (Fig. 300), plates about 0.25-0.35x length of genitalia, in one species plates abruptly bent at right angle ventro-anteriorly with socii and gnathos thus projected cephalad inside cavity of diaphragma. Socii (Figs. 299-300) as very elongate, parallel, subcontiguous, markedly sclerotized rods extended almost to apex of valvae, about 0.50x length of genitalia, extreme bases fused together, distal portion in several species variously dilated, securiform, subclaviform or lobate, outer side of distal half covered with stiff, erect, subspiniform setae. Gnathos (Fig. 299) wishbone-shaped, of delicate appearance; paired proximal arms in several species with basal half extended parallel to and contiguous with socii, single distal arm about half length of proximal arms, straight, projected ventro-caudally (except in species with anteriorly bent basal plates in which whote socii and gnathos are reversed, the gnathos being situated dorsad of the socii rods, with the apex pointed cephalad), apically with minute hook; in some species junction of proximal and distal arms anteriorly produced into short triangular plate immediately ventrad of anus. Vinculum markedly reduced to extremely narrow, inconspicuous rim on anterior emargination of base of valvae, or seemingly absent (Fig. 301). Valvae symmetrical, ventral margins basally fused together, narrowly so in most species (Fig. 301), in few species fusion extended to one third of valva length; base anteriorly deeply U-emarginate, emargination extended to about 0.20-0.45 length of valvae, medially with anteriorly projected thin rod formed by protrusion of fused ventral margins (Fig. 301); in lateral aspect (Fig. 299) valva slender, anteriorly tapered to very narrow, slender point, ventral margin of anterior third concave, outer wall of anterior third below costa with elongate-ellipsoid concavity extended from articulation with pedunculus to submedial sinuation of costa, costa shallowly or deeply concave, with slight or marked sinuation at one third, distal two-thirds densely setose with low cucullar lobe; inner wall in most species without lobes or projections, in some species with medial lobe or short crest; apex constricted, in dorsal aspect spatulate, lobate, finely pointed or sickle-shaped. Diaphragma strikingly expanded into large, deep inpocketing or cavity (Figs. 299-301), in some species extended into abdomen far beyond anterior margin of tegumen, membrane semi-rigid or with portions markedly sclerotized, variously lobate and/or folded, upper and lateral portions with various, striking ornamentation of markedly sclerotized, spinose or dentate plates (Fig. 299) or rows of spines, lower portion posteriorly attached to anterior part of inner wall of valvae. Juxta (Figs. 299-301) in several species as thin, flat, very long rod articulated on medial protrusion of anterior margin of valvae, extended in wall of anterior cavity of diaphragma, variously folded or sinuate, prolonged onto upper diaphragma and, in most species, caudally recurved, fused to based of aedeagus (Fig. 299); in some species with medial joint or pseudo-articulation at point of bending; in some species reduced to thin, almost indistinct ridge of anterior cavity of diaphragma and interrupted before reaching aedeagus. Aedeagus small or diminutive, in some species indistinct and partly membranous, ankylosed by semi-rigid diaphragma, conical and stubby, or slender and hook-like (Fig. 299), or digitate, in some species recessed deeply into antero-dorsal part of cavity of diaphragma, in other species in wall of upper diaphragma and appearing to hang down from latter (Fig. 299); phallotreme apical. Bulbus ejaculatorius small, semi-ovoid.

Female abdomen. T1-T5 as in male, moderately sclerotized. T6-T7 most sclerotized of terga. T6 in most species with anterior margin broadly rounded, conically invaginated and partly recessed under T5 (Fig. 368), anterior third of surface transversely wrinkled. T7 subquadrate, elongate-rectangular (Fig. 368) or elongate-subtrapezoid, about 2x length of T6. S2-S5 as in male. S6 (Figs. 369-370) transverse, antero-medially deeply emarginate with large, bulbous, heavily sclerotized invagination reminding of glandular fovea, in some species bulbous structure externally protruded. S7 (Fig. 369) subtriangular or elongate-rectangular, medially with longitudinal groove extended posteriorly into long, membranous, protruded lobe.

Female genitalia. Intersegmental membrane S7-S8 in some species expanded, semi-rigid and covering part of S8, or flexible and expanded from both sternal and tergal walls, as long as, or longer than, 8th segment so that segments 7 and 8 widely separated with ovipositor extended. T8 elongate-rectangular, slightly sclerotized, posterior margin with some fine setae. S8 in some species with surface markedly sclerotized, sculptured with marked, oblique, crescentic or concentric ridges (Fig. 371), in other species surface slightly sclerotized and with fine, dense longitudinal wrinkles or longitudinal band of fine, spiculate microsculpture; posterior margin medially emarginate, laterally with sparse cluster of setae, bilobate in some species. Ostium medially or in posterior third of quarter (Fig. 371) of S8 in species with marked ridges of fine wrinkles, in anterior third in species with spiculate microsculpture; stergima formed by various sclerotization of S8 or as ring, concave plate or small, stubby cone around ostium. Ductus bursae membranous throughout, fine, ribbon-like, in one species extreme base widened into markedly sclerotized, small antrum, inception laterally on anterior third or on middle of bursa. Corpus bursae (examined in fully inflated condition in only two species) pear-shaped or mushroom-shaped (Fig. 400), with anterior third globulous, posterior two-thirds broadly tubular, gradually tapered into ductus seminalis. Spermatheca (Fig. 400) as in type species (examined in two species). Anterior apophyses 1.0-2.0x length of S8, thin, straight, arising from antero-lateral angle or from lateral margin of S8. Posterior apophyses thinner and about 1.5x length of anterior ones. Ovipositor relatively long, 0.40-0.50x length of T1-T7; in species with elongate intersegmental membrane segment 7-segment 8, ovipositor appearing very long, length of extended portion from posterior margin of 7th segment to apex of ovipositor almost as long as abdomen; papillae anales membranous, sparsely setose.

Monophyly and relationships. — Monophyly of *Serangites* is indicated by the presence of a dense patch of stiff, semi-erect setae dorsally on the apical portion of tergum 8 in males, and by the elongate, bent juxta extended onto the upper diaphragma. *Serangites* is inferred to be related to *Oncoxystus* and *Commodes* based on apomorphic features of the socii.

Included species and generic diversity. — The type species is the only described member of this new genus. In addition I have examined specimens of 10 other undescribed species occurring in western North America.

Geographical distribution. — Endemic to the Nearctic region where it is an exclusively western group whose species are concentrated in California. One species occurs in Arizona and one ranges in the Great Basin region and short-grass prairie north to southern Alberta.

Natural history. — Adults of two undescribed California species have been reared from *Amsinckia gloriosa* Eastw. ex Suksd. and *Amsinckia sp.* (Boraginaceae). Larvae of the undescribed species from the Great Basin and short-grass prairie feed on *Sarcobatus vermiculatus* (Hook.) Torr. (Chenopodiaceae). Adults of some species are nocturnal, those of others are diurnal and visit flowers.

4.17.1 *Serangites powelli* new species

(Figs. 63-64, 299-302, 368-371, 400, 417)

Type material. — HOLOTYPE, male, labelled: 1 mile N of Alpine Lake, Marin Co., California, 3.vi.1964, J. Powell collector [white, printed label] (UCB). PARATYPES, 20 males, 9 females. ALLOTYPE, female, labelled same as holotype, genitalia on slide no. JFL-85-0332 (UCB). Two males, six females: same data as holotype except three specimens with collector as R.L. Langston (one male, one female) and P. Rude (one female); one female with right wings on slide no. JFL-85-0421 (UCB). Fourteen males: same data as holotype except date and collector as 13.v.1966, J. Slater (UCB); one male with genitalia and right wings on slide no. JFL-84-0079. Three males, one female: Alpine Lake, Marin Co., California, 6-vi.1957, J. Powell (UCB). One female: 3 mi. W Fairfax, Marin Co., California, 13.v.1966, J. Powell (UCB); genitalia on slide no. JFL-85-0303. One male: 6 mi. SE Hayfork, Trinity Co., California, 23.v.1973, J.A. Chemsak (UCB); genitalia on slide no. JAP 5202.

Type locality. — 1.6 km (1 mi) north of Alpine Lake, Marin Co., California.

Condition of holotype. — Spread, pinned on minuten, double-mounted on polyporous block, in good condition.

Derivation of specific epithet. — Name in honor of Jerry. A. Powell, outstanding lepidopterist who collected part of the type series as well as most of the specimens of the various species belonging to *Serangites* . Through his collecting efforts of the past 25 years, he has accumulated the largest collection of North American scythridids. I take pleasure in naming this species after him, also in acknowledgement of the generous help and invaluable advice he has extended to me during my studies on scythridid moths.

Recognition. — In external appearance, specimens of *S. powelli* closely resemble those of some undescribed species of *Serangites* and of several other undescribed scythridids. Smaller individuals with very sparse pale suffusion on the forewings (see "Variation" below) superficially could even be confused with some *Rhamphura* or *Asymmetrura* specimens.

S. powelli is readily separable from other members of the genus on characters of the genitalia. In males, the apex of T8 is truncate (Fig. 302), the socii are distally dilated (in lateral aspect) (Fig. 299), the upper diaphragma has a long, heavily sclerotized band, U-shaped in dorsal aspect (Fig. 300), downcurved in lateral aspect, with the ventral, apical portion densely spinose and somewhat dilated (Figs. 299, 301), and the aedeagus is downcurved and situated in the dorsal part of the diaphragma (Fig. 299). In females, S6 has a medial, heavily sclerotized, globulous invagination (Fig. 370), the surface of S8 has many heavy, crescentic or concentric ridges, and the ostium is situated near the posterior margin of S8 and internally opens into a heavily sclerotized, short, anvil-shaped antrum (Fig. 371).

Description. — Size. Forewing length 5.7-7.0 mm (mean 6.4 mm); hindwing length 5.2-6.2 mm (mean 5.7 mm); wing expanse 12.6-15.0 mm (mean 14.2 mm) (15 specimens).

Head. Face olive-brown with moderate or marked reddish or purplish metallic hue, clypeal area and zone around antennal socket with few white and/or tan scales; neck tufts half white, half colored as face. Eye small, about 0.50x width of frons. Haustellum base predominantly covered with olive-brown scales mixed with few whitish scales. Labial palpi with article 1 white; article 2 with basal third ventrally white, rest of article olive-brown with scattered white scales and with same metallic hue as face; article 3 olive-brown with scattered white scales mostly on dorsal side and with same metallic hue as face. Antenna dorsally entirely olive-brtown with same metallic hue as face; ventral side of scape and pedicel and scales of pecten white or ochreous.

Thorax. Dorsal surface colored as face, lateral margins of mesothorax, distal half of tegulae and collar with various mixture of white, whitish or ochreous-drab. Ventral surface white or whitish variously suffused with drab and pale olive-brown and with marked reddish or bluish metallic hue. Legs. Fore- and mid-leg with outer side olive-brown with sparse white suffusion and golden and reddish metallic hue, inner surface mostly white or whitish. Hindleg with outer surface drab densely suffused with white, with marked greenish, golden and reddish metallic hue, inner side white or whitish with same marked metallic hue as outer side.

Wings. Forewing upper surface predominantly olive-brown or grey-drab, variously suffused with white and some rufous-buff, with light or moderate greenish-reddish metallic hue, in most specimens white scales denser along fold or cell and forming very diffuse, broad streak mottled with some diffuse drab-brown dots (Figs. 63-64); in few specimens white and rufous-buff suffusion sparse, wing surface appearing almost uniformly dark; ventral surface brownish-drab or brownish-grey with same metallic hue as upper surface; cilia drab or pale olive-brown with cupreous or golden metallic hue. Hindwing upper surface with same predominant color and metallic hue as that of forewing; ventral surface and cilia colored as those of forewing.

Abdomen. In males, dorsal surface uniformly dark grey or olive-brown with moderate to marked iridescent metallic hue; anal tufts prominent, pale ochreous-drab; lateral portions of T8 with tufts of long, hair-like scales similar to those of anal tufts and contrasting with elongate-oval scales of medial portion and of preceding terga, appressed on tergal surface, not erect as those of anal tufts; ventral surface predominantly whitish variously suffused with drab and olive-brown and with same metallic hue as wings. T8 with distal projection about half length of whole tergum, laterally slightly constricted, apex truncate, dorsal surface of distal third covered with very dense, short, semi-erect, anteriorly directed setae (Fig. 302). Intersegmental membrane T8-tegumen with portion protruded beyond tegumen about 0.40x length of genitalia, moderately convex (Figs. 299-300). In females, dorsal surface with T1 metallic grey, T2-T5 with anterior half metallic grey and posterior half ochreous or ochreous-drab; T6-T7 mostly ochreous or ochreous-drab with some whitish; entire surface with marked iridescent hue; ventral surface predominantly whitish suffused with pale brown or drab, in some specimens lateral portions of S2-S4 drab; entire surface with moderate or marked iridescent hue. T6 (Fig. 368) transversely rectangular, anteriorly rounded and produced under posterior margin of T5. T7 (Fig. 368) subquadrate, anterior margin slightly sinuate. S6 (Figs. 369-370) transverse, anteriorly medially deeply U-emarginate, with heavily sclerotized, globulous or conical nvagination in emargination. S7 (Fig. 369) broadly conical, with shallow medio-longitudinal groove, anterior margin broadly, shallowly concave.

Male genitalia (Figs. 299-301). Tegumen in dorsal aspect (Fig. 300) with relatively broad, almost V-shaped, anterior emargination, outer sides parallel, in lateral aspect (Fig. 299) each half broadly triangular, antero-dorsal angle broadly rounded. Socii in lateral aspect (Fig. 299) slightly downcurved, distal third broadly dilated, subclavate, with small apical hook; in dorsal aspect (Fig. 300) slightly curved and divergent, outer side slightly dilated medially. Gnathos (Fig. 299) with entire length of proximal paired arms extended parallel to and subcontiguous with socii. Valvae in lateral aspect (Fig. 299) with costa moderately concave and distally bulged into low cucullar lobe, apex bilobate in dorsal aspect (Fig. 300), outer lobe rounded, inner lobe pointed. Upper diaphragma with long, markedly sclerotized band, band U-shaped in dorsal aspect with rounded part situated at point immediately cephalad of anus and gnathos (Figs. 300, arms of band downcurved in lateral aspect and in form of brace on each side of diaphragma (Fig. 299), ventral apical part slightly dilated and with spinose surface (Figs. 299, 301). Juxta in form of narrow band bent at acute angle, bend with pseudo-articulation, dorsal half projected caudally to level of posterior margin of tegumen, apically fused to aedeagus (Figs. 299, 301). Aedeagus somewhat sigmoid or hook-like in lateral aspect, downcurved, projected ventrally from upper diaphragma (Fig. 299).

Female genitalia (Figs. 371, 400). T8 elongate-trapezoid, lightly sclerotized, posterior margin with few fine setae. Intersegmental membrane S7-S8 semi-rigid, expanded and folded over and covering anterior two-thirds of S8, with fine longitudinal wrinkles of ridges. S8 (Fig. 371) markedly sclerotized, surface strikingly sculpture with many closely set, crescentic or concentric ridges; distal third with convex, oval, smooth area surrounding ostium and with medio-longitudinal ridge; posterior margin with shallow medial emargination just caudad of

Ostium near osterior margin of S8, perpendicular to sternal plane, as wide as emargination of posterior margin. Base of ductus bursae widened into markedly sclerotized, anvil-shaped , transverse antrum, rest of ductus membranous, fine, flat, ribbon-like, inception on right side of anterior rounded part of bursa. Corpus bursae (Fig. 400) ± mushroom-shaped in ventral aspect, with anterior third subspherical, posterior two-thirds broadly tubular, gradually tapered to form ductus seminalis. Spermatheca (Fig. 400) with medial portion subspherical, anterior (distal) portion tapered, as long as wider proximal portion; ductus spermatehcae with finely coiled section.

Variation. — The specimens examined vary somewhat in extent of pale suffusion and dark mottling of the upper surface of the forewings. In most specimens, the pale suffusion is quite dense and forms a distinct, albeit very diffuse, pale streak or pattern on the disc with some darker, diffuse mottling. In many specimens, the pale suffusion is denser in the distal third giving the appearance of whitish dusting. In some specimens, the pale scales are sparse and the forewings appear almost uniformly olive-brown to the naked eye. Variation in genitalia was not examined.

Geographical distribution and period of flight. — Known only from two localities in northern California (Fig. 417). Adults have been collected from mid-May to early June. One specimen was collected on a composite flower, presumably during day time.

Hostplant. — Unknown.

5. ASSESSEMENT OF MONOPHYLY OF THE FAMILY SCYTHRIDIDAE AND PHYLOGENY OF DESCRIBED NEARCTIC GENERA AND SPECIES

5.1 Introduction

The following chapter presents a discussion about monophyly of the family and a phylogeny of the genera and described species. I have combined discussion of the relationships among genera with those of described species treated in the synopsis into a single phylogeny because of numerous similarities in characters used and in inferred relationships. This reflects the fact that about half of the described species belong to genera here recognized. Of course, with so many undescribed taxa both in North America and in most other parts of the world, any attempt at phylogenetically defining the family Scythrididae and at proposing a classification of included taxa must be regarded as preliminary.

Relationships are expressed in cladograms whose construction was based on principles of phylogenetic systematics (Wiley 1981) by characterizing taxa on the basis of derived character states (apomorphies) and establishing sister group relationships on the basis of shared derived character states (synapomorphies). A rigorous character weighting system (*e.g.* Hecht and Edwards 1977, Marshall 1987), has not been used. Character weighting is a relatively subjective practice, but on the other hand, equal weighting of all characters obscures the value of evolutionary novelties in phylogenetic reconstruction. Nevertheless, I feel that knowledge about distribution of scythridid characters and phylogenetic interpretation of their states is still in a too preliminary state to allow meaningful application of a weighting system. Instead, the phylogenetic reliability of discordant characters and alternative schemes of relationships are evaluated where appropriate.

A major difficulty in polarization of character states at the family and generic levels within the Scythrididae is lack of an hypothesis about a possible sister group to the family and, more generally, lack of cladistic hypotheses about relationships within the Gelechioidea. The number of different classifications of the families of Gelechioidea proposed by various authors (see Hodges 1978: 7, Zimmermann 1978: 207 and following, Inoue *et al.* 1982, Minet 1986) underlines inadequate understanding of composition and relationships of member families.

Another difficulty lies in evaluating the phylogenetic value of many skeletal characters, principally those of the thorax, because of lack of study documenting such structures in gelechioids. Brock (1971) briefly described some thoracic features which he found to be common to several ditrysian Microlepidoptera, but he provided few details and figures and his results are somewhat difficult to interpret. In an attempt to supplement this lack of morphological data, skeletal traits were examined in a limited number of gelechioid and other microlepidopteran taxa (Table 4). Given the enormous taxonomic diversity of those groups, inferences drawn from such limited data must be regarded as very tentative.

Hodges (1978: 8) has suggested groundplan states for some gelechioid characters, mostly of the wing venation and male and female genitalia, but did not suggest which family of Gelechioidea might be most closely related to the Scythrididae. Hodges dismissed Mackay's (1972: 23) suggestion that scythridids might be a group of highly derived Blastobasidae, because the character state used to support Mackay's hypothesis (presence of a submental pit in the larvae) was found to be widespread in the gelechioids, but he did not propose an alternate hypothesis. Group trends in characters of the male genitalia suggest that the Cosmopterigidae are a possible sister group to the Scythrididae: many members of both families exhibit development and modification of parts or all of abdominal segment 8 and/or have asymmetrical genitalia showing a tendency to have fused or reduced parts. However, present knowledge of other characters do not readily support a close relationship between the scythridids and cosmopterigids. Based on characters of the pupa, Mosher (1916) suggested that Scythrididae are part of a group which also includes the Gelechiidae, Momphidae and part of the Cosmopterigidae (Chrysopeleiinae) but this hypothesis is based on retention of a primitive character (presence of a distinct fronto-clypeal suture in the pupa). Recent studies of male genitalia musculature (Kuznetsov and Stekolnikov 1978, 1984) seem to support the view that Gelechiidae, Cosmopterigidae and Scythrididae are more closely related to one another than to other gelechioids but, again, such conclusions are based on reductive trends. Such trends may simply reflect grades of evolution. No cladistic hypothesis of relationships among these taxa has been proposed. A new hypothesis, which is considered to some degree below (see section 5.4.1), is that the Lecithoceridae form the most closely related taxon to the scythridids. Unfortunately, unavailability of specimens of this predominantly Old World group precluded a more detailed analysis of its possible relationships to the scythridids.

Because of the lack of tenable hypothesis about a sister group to the scythridids, polarity of character states was inferred from generalized outgroup (all Gelechioidea) and ingroup comparisons (Ball 1975, Watrous and Wheeler 1981). The criterion of commonality, that is "common is primitive", was used in generalized outgroup comparison. Although not necessarily reflecting reality (Watrous and Wheeler 1981), such a criterion was used when no other evidence was available to warrant a different interpretation. When different states applied to new structures or to a subset of an autapomorphic state of a structure, polarity was inferred using the criterion that simplest is plesiomorphic, because it was deemed more parsimonious to assume that a new development of a structure would originally evolve in a relatively simple state and be subsequently transformed further, rather than evolve in its most complicated state at the onset and be subsequently secondarily reduced or simplified.

Classification was derived directly from the cladogram, using sequencing conventions (Wiley 1981). When relationships were unresolved, taxa were classified sequentially on the basis of overall similarity and amount of apomorphic features of the genitalia, with groups with the most plesiomorphic genitalia placed first. If such a sequence could not be established, taxa of unresolved lineages were classified alphabetically.

Classification at the infra-familial level is primarily based on characters of the genitalia. A survey of other features of the body of adults (the results of which are included in the generic descriptions) indicates relative structural uniformity, in contrast to the variation exhibited by genitalic features, and the relatively small variation observed in those features does not seem to indicate any obvious pattern that can be used in classification of scythridids. On the other hand, the extreme divergence of genitalia readily suggests groupings, but makes it difficult to infer relationships among those groups because they are so divergent from one another. Structural gaps are so wide that analysis of transformation series is hampered. As a result, hypotheses of relationships resulted in few resolved sister groups. Of course, it is quite likely that, as more scythridid taxa become known, several of the present structural gaps will be filled.

Table 4. Gelechioidea and other Lepidoptera species examined for skeletal characters

FAMILY	SPECIES	DISTRIBUTION
GELECHIOIDEA (suborder Ditrysia)		
Blastobasidae	*Valentinia* sp.	Québec
Coleophoridae	*Coleophora trifolii* (Curtis)	Holarctic
Cosmopterigidae	*Limnaecia phragmitella* Stainton	Holarctic
Elachistidae	*Elachista purissima* Braun	western Nearctic
Gelechiidae	*Metzneria lappella* (Linné)	Holarctic
	Gelechia lynceella Zeller	Nearctic
	Lita sexpunctella (Fabricius)	Nearctic
	Anacampsis innocuella (Zeller)	Nearctic
Lecithoceridae (wing structures only)		
	Lecithocera sp.	Ceylon
	Hygroplasta sp.	Ceylon
	Timyra pastas Meyrick	Ceylon
	Tisis bicolorella Walker	Sarawak
Oecophoridae	*Agonopterix pulvipennella* (Clemens)	Nearctic
	Ethmia discostrigella (Chambers)	Nearctic
Stenomidae	*Antaeotricha schlaegeri* (Zeller)	Nearctic
TINEOIDEA (suborder Ditrysia)		
Gracillariidae	*Phyllonorycter* sp.	Ontario
	Caloptilia sp.	Alberta
Tineidae	*Nemapogon granella* (Linné)	cosmopolitan
	Monopis sp.	Manitoba
YPONOMEUTOIDEA (suborder Ditrysia)		
Argyresthiidae	*Argyresthia oreasella* Clemens	Nearctic
Lyonetiidae	*Leucoptera* sp.	California
Plutellidae	*Ypsolopha dentiferella* (Walsingham)	Holarctic

Table 4 (cont.). **Gelechioidea and other Lepidoptera species examined for skeletal characters**

FAMILY	SPECIES	DISTRIBUTION
MICROPTERIGOIDEA (suborder ZEUGLOPTERA)		
Micropterigidae	*Sabatinca* sp.	New Zealand
INCURVARIOIDEA (suborder MONOTRYSIA)		
Prodoxidae	*Prodoxus quinquepunctellus* (Chambers)	Nearctic

5.2 Monophyly of the Scythrididae

Monophyly of the Scythrididae is inferred from the following apomorphic states: (1) very narrow ductus bursae; (2) broad ductus seminalis anastomosed with vestibulum of vagina; (3) lack of signum on the corpus bursae; (4) shape of the apophysis of the metathoracic furca; (5) presence of only two subapical spurs on tarsomeres 1-4; (6) ankylosed aedeagus in male genitalia; and (7) veins R4 and R5 of the forewing extended from a common stalk, with R4 extended to costa and R5 to termen. These states are discussed below. The first three characters are part of the female genitalia and thought to be interrelated; characters (1) and (2) are discussed together.

1-2. Ductus bursae and ductus seminalis.— In female scythridids, the ductus bursae is very fine and delicate (Figs. 372-400). This causes difficulty in dissection of the female genitalia because the duct is difficult to discern among the numerous tracheae and other tissues surrounding the genitalia and is easily severed or destroyed. In some species, however, the distal portion of the duct (toward the ostium) is somewhat widened, and in few species, thinly sclerotized. But the anterior portion and the insertion into the bursa are extremely narrow. The demarcation between the ductus bursae and the bursa is abrupt in most species. The ductus seminalis, through which the sperm is transferred from the bursa to the spermatheca, originates as a narrowing of the posterior part of the bursa and is extended caudally into the vestibulum of the vagina. In most scythridids, there is no distinct demarcation between the bursa, the ductus seminalis and the vagina, all three structures forming a single continuing tube gradually posteriorly narrowed (Fig. 401). In such instances, the morphological delineation of the ductus seminalis from the vagina is indicated only by the insertion of the ductus spermathecae. The connection of the ductus bursae with the bursa is widely separate from that of the ductus seminalis.

In other gelechioids and most other Ditrysia (Fig. 402), the arrangement of the ducts and their relative widths are the reverse of what is found in scythridids: the ductus bursae is a relatively wide duct which is broadly connected with the bursa (the bursa looks like an expansion of the ductus bursae) and, in many species, there is no obvious demarcation between the two structures. In fact, primitively, the corpus bursae is regarded as a mere widening of the walls of the ductus bursae (Klots 1970) and in some Lepidoptera, the distinction between the two structures is rather arbitary (Horak 1984). Both ductus and corpus bursae, though mostly membranous, are relatively stiff; the ductus seminalis, on the other hand, is a narrow and frail duct connected somewhere along the length of the ductus bursae (Sattler 1967: plate 67; Hodges 1971: vii; Gozmány 1978: plate 56) whose other end is sharply demarcated from the vestibulum of the vagina by the narrowness of the insertion point. Because the condition found in most gelechioids is also widespread in Ditrysia (Dugdale 1974), it is considered plesiomorphic. The narrow ductus bursae, and the wide ductus seminalis not demarcated from the bursa and the vestibulum of the vagina are unique features of the Scythrididae and are here considered autapomorphies of the family.

3. Signum.— No known scythridid exhibits a signum. Presence of one or two signa, which are small sclerites in the wall of the corpus bursae, is widespread in other gelechioids and most other groups of Lepidoptera, and is probably part of the groundplan of the Heteroneura (Monotrysia + Ditrysia, *sensu* Davis 1986). Presence of a signum is thus regarded as plesiomorphic in Gelechioidea (Hodges 1978: 8). Loss of signum has evolved a number of times in various species of gelechioids (Hodges 1978: 8) and is here regarded as apomorphic. However, lack of signum is usually observed in isolated species within a genus (*e.g.* Powell 1973: 13, Hodges 1974: 8, 1986: 9) or in various independent lineages within families. Only in scythridids is lack of signum a feature of all members of the family.

Signa are thought to aid in orientation of the spermatophore inside the bursa. Lack of a signum in scythridids is possibly related to the fact that they may not produce, or are capable of chemically dissolving spermatophores: in examination of hundreds of specimens, I have not observed a single female scythridid whose bursa contained spermatophores (whereas I have seen them frequently in other gelechioids), but, instead, I frequently observed a whitish, floculous mass in the bursa. A narrow ductus bursae and wide ductus seminalis may also be correlated with lack of spermatophore in the Scythrididae. Interestingly, in other gelechioids without a signum, there appears to be no modifications of the ducts (*e.g.* Clarke 1941b, pl. 14, figs. 89-90, 92).

4. Apophysis of metathoracic furca.— The apophysis of the metathoracic furca has a characteristic aspect in scythridids (Figs. 138-143). It is made up of two pairs of smaller projections which are extended dorsally from the base of the apophysis; those of the anterior pair are very short, stubby and projected dorsally, those of the posterior pair are long and extended dorso-posteriorly , more or less parallel to the antero-medial process of the furca. Phylogenetic interpretation of this character state is tentative here because there are no published study of the metathoracic furca in Gelechioidea. Brock (1971) has dismissed the furca of primitive Ditrysia (= Microlepidoptera) as presenting little variation, but his conclusion was based on examination of a very limited number of taxa within that group. In a preliminary study of this structure in gelechioids and various groups of Microlepidoptera (see Table 4), however, a significant amount of variation was observed, indicating potentially valuable characters for phylogenetic analysis. Keeping in mind the limited number of gelechioid species examined, it can be said at this stage of the analysis that the shape of the furcal apophysis of the Scythrididae is unique within the superfamily and, thus, tentatively inferred to be autapomorphic. In other gelechioids, the posterior pair of smaller apophyses is either of equal length to or shorter than the anterior pair, or absent (Figs. 144-145). The latter is also the state found in yponomeutoids and tineoids (Figs. 146-149).

Two features of the gelechioid furca are worth noting here. The first is a modification of the boundary region between the furca itself and its stem: the branched lamellae forming the furca are basally demarcated from the stem of the furca, which forms the ventral strut of the whole structure, by a line resembling a joint or articulation (Fig. 136). This line is absent in tineoids, yponomeutoids and non-ditrysian Lepidoptera, thus the stem and furca appear to form a continuous structure (Fig. 137). The second feature is that the furcal apophysis are extended from the anterior portion of the anteromedial process of the furca in gelechioids (Figs. 138-140, 144) whereas it is extended from the medial or posterior part of the process in tineoids and yponomeutoids (Figs. 147, 149; also Davis 1978a: 8, figs. 32, 35, 38, 41; Davis, 1978b: 20, figs. 48, 49; Davis, 1986: 36-37, fig. 109, 112, 115, 118, 122, 125) Both states may represent gelechioid apomorphies, but the characters warrant further investigation throughout the gelechioids, yponomeutoids, tineoids and higher Ditrysia before better conclusions can be drawn.

5. Tarsal spurs.— The distribution of the number of subapical spurs on tarsomeres 1-4 of all legs has been reported in few publications. Such spurs are somewhat imprecisely figured in some works (*e.g.* Common 1970: 767; Davis 1986: 34), and their number has been discussed in some groups of Tortricidae although they have been described as setae or bristles (Yasuda 1972, Horak 1984). The subapical spurs are not to be confused with other spurs and/or spines which are variously distributed on the shaft of tarsomeres. The subapical spurs are located on the ventral side of tarsomeres and, when present, are in pairs (Fig. 79) or triplets (Fig. 82). Some tortricoids have only one, others have a series of 7-9 (Yasuda 1972).

In scythridids, two spurs are present (Figs. 79-81), although in some groups (*Areniscythris*, some *Neoscythris*), they are considerably reduced and inconspicuous (Fig. 81). Additional spurs on the shaft (Fig. 80) are a rare occurrence in scythridids. In most other gelechioids, there are three spurs (Fig. 82), but in some Coleophoridae, there are none. The Stathmopodidae are described as having the hind tarsi (and tibiae) with a whorl of stiff bristles (Common 1970: 818) but I have been unable to examine specimens of that group to ascertain the precise nature of that character. The three-spur state is inferred to be plesiomorphic because it is widespread in Microlepidoptera and occurs even in primitive Micropterigidae (*Sabatinca*). Loss of spurs must have been derived independently a number of times, because it occurs at least in Lyonetiidae (*Leucoptera*), Gracillariidae (*Caloptilia*), some Tortricinae (Yasuda 1972) and Olethreutinae (P.T. Dang, pers. comm. 1987), and Coleophoridae. A two-spur state is inferred to be apomorphic in the scythridids, but shows homoplasy in some other gelechioids (*e.g.*

Coleophoridae) and probably several other ditrysian taxa. Because the apomorphic condition involves a simple loss, this character must be used with caution in phylogenetic inference. Again, as with character (5), tarsal spurs need further investigation across the Gelechioidea.

6. Aedeagus ankylosis.— Ankylosis, that is partial or complete immobilization, of the aedeagus is effected is three ways: either by a juxta, one end of which is tightly attached or fused medio-ventrally or baso-ventrally to the aedeagus, or by a sclerotized band of the anellus which forms a ventral process of the aedeagus (= manica *sensu* Klots 1970), or by a stiffened anellus surrounding the basal part of the aedeagus. In ankylosis by a juxta or manica, the end of the juxta or manica which is opposite to the aedeagus is articulated with or fused to the base of the valvae or the vinculum-valvae complex (in many scythridids, the vinculum is markedly reduced and fused to the base of the valvae); in ankylosis by a stiffened anellus, the semi-rigid anellus forms a very diffuse sclerite that is attached around the anterior apex of the aedeagus and is extended into the diaphragma.

An ankylosed aedeagus is uncommon in gelechioids and inferred to be apomorphic. However, in addition to the Scythrididae, the condition is also found in two subfamilies of Cosmopterigidae; in Cosmopteriginae, the aedeagus is ankylosed by a sclerotized anellus with the surrounding diaphragma, whereas in Chrysopeleiinae, ankylosis is effected by a ventral band attached to the saccus (= manica?) (Hodges 1978: 11). In other gelechioids and in the majority of Ditrysia, the aedeagus is free in the membranous diaphragma, although a juxta is commonly present (as a plate ventrad of but separate from the aedeagus). The similar conditions in scythridids and cosmopterigids are here regarded as homoplastic because no other known character state supports a close relationship between them. However, ankylosis of the aedeagus alone provides tenuous evidence for monophyly of the Scythrididae because it occurs in different forms within the family. This suggests that the condition has evolved more than once in scythridids. Ankylosis of the aedeagus possibly represents a grade-level condition and may be correlated with other modifications of the male genitalia such as reduction and/or fusion of parts (*e.g.* vinculum and valvae), and development of tergum and/or sternum 8 (the latter is observed in many scythridids and in several cosmopterigids, but in cosmopterigids, modifications of parts of segment 8 do not attain such extremes as in scythridids).

There is considerable difficulty in homologizing structures supporting the aedeagus (Klots 1970), and this problem is particularly acute in the Scythrididae because of extreme fusion, modification and asymmetry of structures in this region. The anellus and juxta are both part of the same morphological region, the diaphragma (Klots 1970), and in some scythridid taxa (*e.g. Commodes* , *Serangites*), additional sclerites of uncertain homology are present within the diaphragma around the aedeagus. Further study is required to resolve problems of possible homoplasy in ankylosis of the aedeagus.

7. Forewing veins R4 and R5.— The origin of veins R4 and R5 of the forewing from a common stalk, with R4 extended to costa and R5 to termen, is a character state frequently used to diagnose scythridids (Figs. 150-161), but it occurs in various gelechioids (*e.g.* Common 1970, figs. 36.28, 36.31). This state is related to narrowed wing tips. Bengtsson (1984: 24), citing Falkovitsh (1981), indicated that this state did not occur in the Palearctic scythridid *Eretmocera medinella* (Staudinger), but Falkovitsh 's figure 424 .1a (1981: 448) and my own observations indicate that this is incorrect (R4 and R5 show the typical state of scythridids, but the veins are somewhat obsolete). Stalking of R4 and R5 is regarded as a specialization within the gelechioids (Hodges 1978: 8), and is thus apomorphic, but homoplastic. It is here considered to provide additional support for monophyly of the scythridids because it is concordant with other apomorphies discussed above.

5.3 Analysis of character states

Distribution of states of characters used in phylogenetic reconstruction are listed in Tables 6-8 and discussed below. Six characters which are used at a first level of analysis to provide evidence of monophyly for two major groups of lineages are described first. Character numbers start at 8, consecutive with those of the seven characters used above in discussion about monophyly of the family. At the second level of analysis, distribution of 34 additional characters is described to infer relationships among members included in each of the two major complexes derived from the first level of analysis: 18 characters are analysed for the first lineage, hereafter called the *Scythris* complex, and 16 for the second lineage, hereafter called the *Arotrura* complex. For convenience, each of the two complexes of genera is informally designated after the oldest generic name in the group. The *Scythris* complex includes both formal genera and informal groups of described species still presently included in *Scythris* . Those informal groups consist of species which are not closely related to members of *Scythris* in the strict sense defined in this work, but provisionally left in that genus until they are further revised, and genera proposed for their inclusion. Such informal groups are called lineages hereafter; their definition in terms of apomorphic character states is presented in the discussion about phylogeny (section 5.4 below) and their constituent species are listed in Table 5. For convenience, lineages are referred to after the name of one of the included species of a group, such as the "[species] lineage"; for example, the related species *Scythris trivinctella* (Zeller) and *S. ypsilon* Braun are inferred to belong to an undescribed genus not closely related to *Scythris* and are referred to as the "*trivinctella* lineage".

Several characters of high phylogenetic value were not included in the character analysis because they exhibited too complex transformations to permit meaningful analysis at this time. Despite limited usefulness, a few such characters were, nevertheless, included in the analysis as examples (characters 14, 15, 17, 20); their numerous states and the uncertainty about polarity suggest that these characters should be used at a different level of phylogenetic analysis. Unanalyzed characters and their presumed apomorphic states, when deemed phylogenetically important, are discussed or mentioned below in the analysis of phylogenetic relationships (sections 5.4.2 and 5.4.3), under the pertinent lineages.

5.3.1 Characters used for evidence of major lineages

The distribution of states of characters 8-13, discussed below, is listed in Table 6.

8. Frenum.— Two states are recognized: (1) absent; (2) present. A frenum does not occur in most other groups of gelechioids nor in other Lepidoptera (R.W. Hodges, pers. comm. 1986) and its presence (state 2) is inferred to be apomorphic. This accessory wing coupling structure was described in section 2.4 and is illustrated in Figs. 150-156 and 159-161. It was first reported by Keifer (1937: 187) in *Scythris* (= *Rhamphura*) *altisierrae*, and illustrated in Common (1970: 817, fig. 36.28d) for an unspecified Australian scythridid. There appears to be no mention of this character nor discussion of its distribution in publications, even though this study has shown a frenum to be present in numerous scythridids. A frenum is also present in Lecithoceridae (R.W. Hodges, pers. comm. 1986, and pers. obs.), although this is not stated nor illustrated in Gozmany's (1978) revision of Palearctic members of the family, and in *Physoptila* (Common 1974: 105, fig. 39), a genus which is now included in the Gelechiidae (Sattler 1973).

It is rather curious that such a striking structure of the wings has not been more extensively reported and studied before, and this may be the result of the method commonly used in preparation of the wings to study venation: it is habitual to descale the wings, a process that removes the setiform scales of the frenum.

9. Shape of sternum 8 of males.— Shape of sternum 8 of males is extremely varied in scythridids. For this first level of analysis, three states are recognized: (1) unmodified; (2) reduced and surrounded by the base of vinculum-valvae; (3) variously modified and enlarged.

State 1 is widespread in gelechioids and regarded as the groundplan state in scythridids. An unmodified sternum 8 is about the same size and shape and of the same degree of sclerotization as the preceding sterna. In scythridids, this state occurs in various lineages (*e.g.* *Areniscythris*, *Asymmetrura* — see Table 6). In state 2, sternum 8 is less than half the size of preceding sterna (which also tend to be reduced in area and in degree of sclerotization in several taxa) and is laterally and posteriorly surrounded by a deep emargination of the anterior part of the fused vinculum-valvae (*e.g.* Figs. 270, 274, 279 show such emargination of the valvae). In several taxa with such an arrangement, sternum 8 is partly fused to the anterior margin of the valvae (*Mimiella* species). In taxa with a very deep anterior emargination of the valvae (*Meniscotus* , *Oncoxystus* , *Commodes* , Figs. 291, 296, 301), sternum 7 is also surrounded by the crescent formed by the base of the vinculum-valvae.

Under state 3 are grouped all other forms of sternum 8. Those involve an enlargement and greater degree of sclerotization of that sternum as well as varied and, in some taxa, remarkable modifications in shape. Obviously, such developed sterna 8 must be functionally involved with the genitalia proper. In many taxa, sternum 8 alone is modified while in others, tergum 8 is also markedly developed and both sternum and tergum enclose the genitalia and possibly function together.

10. Shape of tergum 8 of males.— Similar to sternum 8, tergum 8 has remarkebly varied shapes in scythridids. Three states are recognized at this level of analysis: (1) unmodified; (2) variously modified and free; (3) enlarged, hood-like and fused to tegumen.

State 1, an unmodified tergum, similar in shape and size to preceding terga, is regarded as the groundplan state for the family. State 2 includes a number of forms of tergum 8, but in scythridids with this state, the tergum is free from the genitalia; in some, it may be closely associated with a developed or modified sternum 8 (*e.g. Scythris trivinctella* , *S. ypsilon* , Figs. 197-198, 202).

In state 3, the enlarged and markedly sclerotized tergum 8 forms a hood dorsally covering the genitalia and has antero-lateral lobes or arms extended latero-ventrally and fused or firmly attached alongside the posterior margin of the tegumen. The tergum is also firmly attached or fused to the stiffened intersegmental membrane that link it to the tegumen (see character 11 below)

(Fig. 303). Fusion of tergum 8 with the dorsal part of the genitalia may represent the end of a transformation series whose intermediate stage is represented by state 2, but this cannot be confidently determined at present.

11. Intersegmental membrane between tergum 8 and tegumen.— Two states are recognized: (1) membranous; (2) sclerotized. A membranous intersegmental membrane connecting the tegumen of the male genitalia to tergum 8 is the state found throughout the gelechioids and many scythridids and it is hypothesized to be plesiomorphic. A sclerotized membrane is found only in those scythridids which have a hood-like tergum 8 firmly attached or fused to the tegumen (state 3 of character 10) (Fig. 303) and is inferred to be apomorphic.

12. Socii.— Four states are recognized: (1) small, membranous lobes; (2) large, semi-sclerotized lobes; (3) markedly sclerotized arms; (4) absent.

Because socii occur widely in the gelechioids (Hodges 1974: 8) and in various families of Lepidoptera (Klots 1970) and are most commonly present as membranous and setose lobes, state 1 (Figs. 203-204) is considered plesiomorphic. In state 2, the lobes inferred to represent socii are enlarged, prominent and moderately sclerotized (Figs. 214, 218). This state is characteristic of *S. inspersella* and *S. noricella*. In several scythridids, a pair of markedly sclerotized arms extended from the uncus area are interpreted as highly modified, apomorphic socii (state 3; see section 2.4 for morphological interpretation of those structures) (Figs. 264, 272, 283, 286, 295, 300, 303). Absence (state 4) is inferred to be the result of secondary loss.

13. Posterior margin of sternum 7 in females.— The four recognized states are: (1) entire; (2) emarginate; (3) pincer-like; (4) lobate.

In gelechioids, an unmodified sternum 7 with an entire margin is common in many groups; therefore it is considered to represent the groundplan state in scythridids. States 2 and 3 are hypothesized to be part of a three-state phenocline: entire — emarginate — pincer-like (state 1 to state 3). State 2 encompasses various forms of medial emargination (Figs. 304, 309, 326, 328, 340, 342), including cleft-like ones without lateral projections, and has probably arisen more than once through parallel evolution because it occurs in various scythridid groups which otherwise appear unrelated on the basis of other genitalia characters. In state 3, the posterior sternal margin is deeply emarginate or cleft and both sides of the cleft are caudally protruded to form pincer-like projections (Figs. 332, 334, 336, 338). Such projections extend over or brace the sterigma. State 4 represents a different apomorphic trend in which the posterior margin of sternum 7 is medially produced into a membranous or hyaline lobe which is reminescent of a sort of glandular structure (Figs. 312, 345, 347, 353, 359, 362, 369).

5.3.2 Characters analyzed for relationships within the *Scythris* complex

The distribution of states of characters 14-31, discussed below, is given in Table 7.

14. Shape of sternum 8 of males.— Shape of sternum 8 is extremely varied in scythridids, from an almost unmodified sclerite, little differentiated from the preceding abdominal sterna, to a strikingly developed structure. The diversity of states represented among taxa treated in this work is only a fraction of that present in the family. This suggests that the phylogenetic value of those states probably lies at various, yet undetermined, hierarchical levels. Such a labile structure may frequently exhibit parallel evolution and this would reduce its value in phylogenetic interpretation at some levels. However, the shape of sternum 8 is remarkably constant and highly characteristic in several groups, providing good apomorphies for their definition, while in other lineages (for example *Neoscythris*), it varies markedly in shape and size among member taxa. For this reason, the character was included in the analysis.

The recognized states are: (1) undifferentiated; (2) triangular-bifurcate; (3) triangular-digitate; (4) transverse with thick anterior apodemes; (5) pincer-like; (6) narrow and bi-crescentic; (7) others.

State 1 is regarded as the plesiomorphic condition, as discussed above (see character9). All other states except (7) are inferred to be apomorphic but it is very difficult at this point to order them in one or more transformation series. State 2 describes the condition characteristic of members of *Scythris s. str.*, in which sternum 8 is markedly enlarged, completely surrounding the ventral side of the genitalia, and has the posterior margin medially produced into a furcate projection (Figs. 177-178, 183-184, 192-193). State 3 describes the condition found in *S. trivinctella*, in which the sternum is developed as in *Scythris s.str.* but has a finger-like or spine-like projection instead of a bifurcate one (Fig. 198); this may represent part of a morphocline that would also include state 2, or a parallel development. In state 4, sternum 8 is a relatively narrow, convex, half-ring-like band with thick apodemes extended from its antero-lateral angles into the abdominal cavity; this condition is characteristic of members of *Rhamphura* (Fig. 175). State 5 is found in the *S. basilaris* lineage, in which sternum 8 consists of a transverse plate with sublobate antero-lateral apodemes extended into the abdominal cavity and thick, pincer-like latero-caudal projections lined with very fine pilosity on one side (Figs. 205-206, 209). In state 6, found in *S. noricella*, sternum 8 is reduced in size and subdivided into two transverse, subcrescentic plates (Fig. 217).

Under state 7 are subsumed a variety of forms of sternum 8, many of them present in members of *Neoscythris*. Among the latter, one of the most remarkable developments is exhibited by *N. planipenella* whose sternum 8 is divided into two valva-like halves (Fig. 191). Although state 7 probably includes apomorphic forms, it is almost akin to an undetermined condition and is not used here to support the monophyly or infer relationships of taxa with the condition.

15. Shape of tergum 8 of males.— Shape of tergum 8 was previously discussed at the first level of analysis (see character 10 above). As for sternum 8, tergum 8 of males is remarkably varied and this variation seems to follow a similar pattern, that is, some groups are characterized by a single condition whereas others display several forms. However, few states are recognized here because the variation within groups is even more pronounced than for sternum 8. The states are: (1) unmodified; (2) Y-shaped; (3) elongate flap; (4) with spined posterior margin; (5) linguiform with anterior apodemes; (6) others.

The plesiomorphic condition is represented by state 1 (see discussion under character 10). In apomorphic state 2, the tergum is reduced in extent and degree of sclerotization and is characteristically Y-shaped or T-shaped, with the paired arms forming the anterior part of the tergum; in specimens with such a tergum, the posterior margin is folded ventrally and lined with long, setiform scales arranged in a fan-shaped brush projected above the genitalia (Figs. 174, 263). This state is characteristic of members of *Rhamphura* . State 3 is found only in *S. noricella* and is represented by a narrowly elongate and very thinly sclerotized tergum extended above the genitalia (Fig. 216). In state 4, which is characteristic of the *S. anthracina* lineage, the posterior margin of the somewhat differentiated ternum 8 bears a series of spines, which are probably modified scales because they are socketed in a similar way (Fig. 223). In state 5, the linguiform tergum 8 has the antero-lateral angles prolonged into apodemes extended into the abdominal cavity; both apodemes and the anterior margin are lined with a continuous cuticular thickening that also has a pair of extensions directed posteriorly along the lateral margins (Fig. 232). Such a tergum 8 is characteristic of members of *Areniscythris* .

All other forms of tergum are included under state 6, which is treated as state 7 of character 14 (see above).

16. Processes of tegumen.— Two states are recognized: (1) processes absent; (2) processes present. The processes are paired beak-like extensions of the latero-posterior margin of the tegumen, on each side of the anus (Figs. 173, 176, 179-180). Their ventral margin is lined with stubby, tooth-like, darkly sclerotized pegs (Fig. 85), and dorsally they are humped and bear a varied patch of bristles. Extended inside the tegumen is a pair of glanduliform sacs whose membranous walls appear spiculate; each sac is posteriorly tapered into a duct which opens at the oblique apical portion of the process and externally appears like a fovea (Figs. 83-84). Homology of the pegged processes is uncertain. They are more or less in the position of socii but there is no trace of a fusion line to suggest they are structures of tergum 10 that have become fused to the tegumen [uncus, socii and gnathos are thought to be derivatives of segment 10 whereas the tegumen is thought to be derived from tergum 9 (Klots 1970)]. Because there are no recognizable structures resembling the uncus or gnathos in specimens possessing pegged processes, the entire segment 10 is inferred to have been lost.

These processes and associated "glands" are found only in members of *Rhamphura* . Because such structures are unique within the scythridids, their presence is inferred to be apomorphic. Somewhat similar processes are found in the same position in several genera of hypertrophine Oecophoridae (*e.g. Peritropha* , *Oxytropha* , *Allotropha* , *Eupselia* , *Progonica* and *Epithetica* ; see Common 1980) but they lack pegs and glanduliform sacs; they are inferred to be the result of convergence.

17. Uncus shape.— The uncus, when present, has extremely varied shapes in scythridids and phylogenetic interpretation of this character is thus difficult. Nine states are recognized here, but some of these are encompassing rather broad variation: (1) digitate; (2) horseshoe- or U-shaped; (3) bilobate; (4) cylindrical; (5) brace-like; (6) tooth-like lobe; (7) vestigial lobe or protrusion (8) absent; (9) others.

State 1 is tentatively inferred to represent the plesiomorphic condition in scythridids because it occurs in somewhat similar forms in various primitive gelechioids such as Oecophoridae (Hodges 1974) and in other Ditrysia such as Tortricidae (Horak 1984). Under that state, however, are subsumed various forms of digitate uncus, for example with a forked apex or with lateral lobes (*e.g.* Figs. 249, 251) (much variation is present in members of *Neoscythris*), which are considered of value at a lower taxonomic level than that analysed here.

All other states are inferred to be apomorphic. State 2 (Figs. 186, 188, 204), as in state 1, includes some variation not analysed. State 3, for example as found in *S. trivinctella* specimens (Figs. 194-195), may represent a condition derived from state 2 in a morphocline, in which much of the horseshoe-like uncus has become reduced and only the apical portions of the lobes are left; it is also possible that the setose lobes are sclerotized socii, somewhat analogous to but less developed than state 2 of character 12 (see above). State 4 is found only in some *Neoscythris* (*e.g. N. confinis*) and describes an uncus which forms a cylindrical sheath around the anal tube (Fig. 257). In state 5, which occurs in the *S. anthracina* lineage, the uncus is shaped like a half-ring or an inverted horseshoe whose arms are joined to each side of the divided tegumen and the rounded portion is turned caudally (Figs. 220-221). States 6-8 may represent a morphocline in which the uncus becomes gradually reduced and eventually lost. However, scythridids without uncus need not necessarily to be derived from an ancestor with a tooth-like uncus. The variation in uncus states suggests that various levels of apomorphy are represented but those have not been evaluated. Trends toward reduction and loss of uncus must have evolved more than once within the family and such states must be used with caution in phylogenetic inference. On the other hand, an apomorphic condition such as that of state 5 in the *S. anthracina* lineage appears to be unique and provides a good indicator of monophyly.

Other forms of uncus are included under state 9, similarly to state 7 of character 14.

18. Gnathos position.— Three states are recognized: (1) medial; (2) skewed leftward; (3) absent.

The plesiomorphic condition (state 1) for the position of the gnathos is for the paired proximal arms to extend symmetrically and to join medially ventrad of the anus, in effect forming a sort of girdle around the latter. This is the widespread condition in gelechioids and most Lepidoptera. In many scythridids, the left proximal arm of the gnathos is markedly larger than the right arm and, in caudal view, appears displaced to the left side of the genitalia (state 2); in such a condition, most of the left arm is fused to the left latero-posterior margin of the tegumen and the right arm is extended more or less transversely or obliquely to join the apical part of the left arm below the anus (Figs. 235-237, 240-241, 252, 261); in several scythridids with such a condition, the right arm is diminutive and very thinly sclerotized. This condition of the gnathos is considered apomorphic. Presence of a gnathos is hypothesized to be part of the gelechioid groundplan (Hodges 1978: 8), hence absence (state 3) is inferred to be the result of secondary loss and thus is apomorphic.

The curious gnathos of *S. noricella* (Figs. 218-219) specimens cannot be readily classified under either state 1 or 2. The base of both proximal arms is symmetrical but their course is distally sinuous and somewhat irregular, and it tends to be more on the left than on the right side of the genitalia. However, the basal portion of neither arm is fused to the tegumen. Aspect of the gnathos as a very thin, ribbon-like, sinuous band, suggests an independent modification from the type of asymmetry described for state 2. For purposes of this analysis, the gnathos of *S. noricella* is classified as medial (state 1).

19. Proximal arms of gnathos.— Four states are recognized: (1) simple; (2) left arm lobate; (3) right arm lobate; (4) junction of both arms protruded. For species lacking a gnathos, "not applicable" is entered in Table 7. Because simple proximal arms are widespread in scythridids, state 1 is inferred to be the plesiomorphic condition. In several scythridids, the base of either the left (Figs. 235-236, 240, 246, 248, 252, 257, 261) or of both (Figs. 226-227, 230-231) proximal arms is caudally or dorso-caudally produced into a lobe or process. The process of the left arm can be strikingly large and has species-specific shapes; it most commonly occurs in scythridids which possess a leftwardly skewed gnathos (state 2 of character 16). A similar, though less developed, lobe is present at the base of the right gnathos arm in some scythridids with a lobe on the left arm. Assuming that a transformation series would have evolved from simple to more complex, state 3 is hypothesized to be the more derived state of a morphocline state 2 — state 3. State 4, also inferred to be apomorphic but the result of a different transformation, is found only in the *S. anthracina* and *S. trivinctella* lineages and involves a medial projection which is formed by the junction of both proximal arms (Figs. 194-195, 199, 220).

20. Distal arm of gnathos.— Ten states are recognized: (1) thorn-like (Figs. 185, 187, 193); (2) sigmoid (Fig. 230); (3) rod-like (Fig. 238); (4) clavate-serrate (Figs. 243, 248); (5) long, bent hook (Figs. 249, 257, 260); (6) membranous (Fig. 233); (7) ribbon-like (Figs. 218-219); (8) with warped apical plate (Figs. 194, 196, 199, 222); (9) simple (Fig. 224); (10) absent. For species lacking a gnathos, "not applicable" is entered in Table 7. The number of states described here underlines the great diversity of forms of this structure among scythridids, and many more are present in undescribed taxa not treated here. This variation also complicates assessement of polarity.

Because a sister group to the Scythrididae has not been established at present and because the gnathos is a varied structure also in other gelechioids, inference about the plesiomorphic condition in scythridids is very uncertain. Hodges (1978: 8) hypothesized that the primitive gelechioid gnathos might be a semicircular band with small spicules on the dorsomedial surface, which means that in its groundplan state, the gelechioid gnathos would lack a distal arm. Traugott-Olsen and Nielsen (1977: 29), however, seem to consider the spinose, medial knob attached to the junction of the proximal arms and occurring in depressariine Oecophoridae, Elachistidae, Coleophoridae and Agonoxenidae to represent a plesiomorphic condition in gelechioids, but I consider it more likely to be apomorphic because of its relative complexity. The form of distal arm of gnathos most similar to a state found in scythridids is observed in Lecithoceridae, which have a thorn-like or hook-like distal projection reminding of that found, for example, in *Scythris immaculatella*, or the European *S. clavella* and *S. cicadella* [compare Gozmány 1978, various figs. in plates 16-55 (Lecithoceridae) and Bengtsson 1984, figs. on pp. 81-88 (Scythrididae)]. Hence, a thorn-like distal arm (state 1) is tentatively considered plesiomorphic. Another, admittedly tenuous, argument to support this hypothesis is that the scythridids having this state generally also have genitalia with a more primitive appearance, *i.e.* symmetrical, all structures readily recognizable in the typical lepidopteran plan with typical tegumen, uncus, gnathos, simple and attenuate aedeagus, and typical (albeit partly fused in many) valvae.

All other states are considered apomorphic. Most are regarded as representing various independent developments but it may be that some of them are parts of morphoclines which cannot be clearly established at present because of wide morphological gaps. This is a distinct possibility, for example, in scythridids which have the gnathos base skewed leftward: if these are inferred to form a monophyletic clade based on that character state, then the various developments of the distal arm may be part of one or more morphoclines which would include reduction to a membranous projection (*e.g. Asymmetrura graminivorella*) or loss (*Scythris*

21. Juxta.— Four states are recognized: (1) broad, shield-like, free from valvae; (2) slender, fused to vinculum-valvae; (3) small band submedially fused to aedeagus; (4) elongate process fused basally to aedeagus.

Presence of a shield-like juxta is considered part of the gelechioid groundplan (Hodges 1978: 8) and is common in Lepidoptera (Klots 1970). State 1 is found in the *Rhamphura* lineage; the position and outline of the juxta of those scythridids reminds very much those of Oecophoridae with a more generalized, primitive genitalia (*e.g.* Clarke 1941, pls. 8, 9, 25), although the surface of juxta of *Rhamphura* has some unusual, probably apomorphic, features such as a medio-caudal protuberance and finely pointed microsculpture (Figs. 83-84, 173, 176). State 1 is inferred to be plesiomorphic. State 2 is found in the *S. basilaris* and *S. interrupta* lineages (Figs. 203-204, 211) and is regarded as apomorphic: in those taxa, the juxta is elongate, extended parallel to the tegumen in the longitudinal plane of the genitalia (a primitive juxta lies in the transverse plane of the genitalia) and is basally fused with the vinculum-valvae complex so that it appears as a dorso-caudal extension of the latter. However, homology of the structure interpreted as the juxta in state 2 is uncertain: it is based on the fact that it underlies the aedeagus, is distinct from the valvae and has an emarginate or cleft apex reminding of a typical juxta. State 3 is found in most groups here, and consists of a narrow band protruded submedially from the ventral wall of the aedeagus and articulated onto the antero-basal region of the vinculum-valvae (*e.g.* Figs. 199, 225, 244). In state 4, the presumed juxta consists of an elongate band or process ventrally protruded from the base of the aedeagus and articulated in a similar position as that described for state 3 (*e.g.* Figs. 185, 213, 218). There is also uncertainty about the homology of the structures referred to as juxta in states 3 and 4 (see character 40 below in analysis of characters of the *Arotrura* complex).

22. Bulbus ejaculatorius.— Two states are recognized: (1) small; (2) larger than genitalia. In state 1, the membranous sheath forming the bulbus is a relatively small sac, suboval in outline and broadly opened at its cephalic end, which surrounds the distal portion of the ductus ejaculatorius (*e.g.* Figs. 173, 249). Because this structure is seldom described or illustrated in taxonomic works on Microlepidoptera, it is presumed that the common state in gelechioids is that of an undifferentiated and small membranous sheath extended from the base of the aedeagus. Consequently, state 1 is regarded as plesiomorphic in scythridids. In apomorphic state 2, which is found in members of *Asymmetrura*, one part of the bulbus ejaculatorius is enormously expanded and much larger than rest of the entire genitalia (Figs. 233, 239, 244, 248). This enlarged portion forms an anteriorly blind sac. The ductus ejaculatorius enters the bulbus through a broad opening located relatively proximate to the aedeagus, is extended cephalad inside the expanded part of the bulbus and then looped back toward the aedeagus. In addition, the membrane of the duct has a different aspect depending on position: the portion of the duct between the testes and the loop inside the bulbus ejaculatorius has a granular texture, whereas the portion of duct between the loop and the aedeagus has a smooth texture. A possible interpretation of this difference in membrane texture is that the smooth portion represents the ductus ejaculatorius proper, whereas the granular portion represents the vesica with a remarkable cephalic extension[1].

23. Fusion of valvae.— Four states are recognized: (1) valvae free; (2) valvae basally ankylozed; (3) valvae basally fused; (4) valvae basally and medially fused.

Free valvae (state 1), in which the valvae are separate with their bases medially hinged on one another, are considered plesiomorphic because they occur widely in Heteroneura. In this state, the bases of valvae are hinged medially on one another and laterally on the vinculum, and the valvae "open" in the transverse plane of the genitalia, functioning as claspers. Occurrence of this state is rare in scythridids and, among taxa included in this analysis, found only in the *Rhamphura* lineage (Fig. 179). In apomorphic state 2, the valvae are basally contiguous but, even though not fused, have very limited lateral movement. This is caused by the configuration of the vinculum and of its articulation to the valvae: the vinculum is extended caudally beneath the bases of valvae, with one part of the joint (formed by the connecting membrane) located along the medio-longitudinal line of the vinculum; in addition, the latero-basal portion of the vinculum is dorsally arched, somewhat bracing the valvae transversely; thus articulation between vinculum and valvae occurs in two planes nearly perpendicular to each other, thereby markedly limiting movement of the valvae. This condition is found in *Scythris limbella*, and may represent an intermediate stage between free and fused valvae. In apomorphic state 3, the bases of valvae are fused to one another and to the vinculum (*e.g.* Figs. 211, 250). In several scythridids with state 3 (*e.g.* some *Scythris*, members of the *S. trivinctella* and *S. anthracina* lineages), the vinculum-valvae complex retains some mobility along the dorso-ventral axis whereas in many others, the parts are in very tight contact with or fused to the dorsal part of the genitalia (tegumen-uncus-gnathos complex), with little or no movement possible (*e.g. S. basilaris* lineage, *Asymmetrura*,

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[1] The vesica is the taxonomic term used by lepidopterists to designate the endophallus, or invaginated distal part of the aedeagus (Klots 1970). In connection with this, it is noteworthy to mention that the vesica of scythridids does not seem to be eversible, a state that is possibly functionally related to the ankylosed aedeagus and perhaps also to the peculiar modifications of the female genitalia (see characters 1-3 and 6).

Neoscythris). Apomorphic state 4 involves fusion of the medial portion of the valvae in addition to that of the basal portion. This condition is found only the *S. inspersella* , *S. noricella* and *S. inornatella* lineages. In the *S. inspersella* lineage, the fusion "bridge" is relatively narrow and transverse (Fig. 214), whereas in the latter two lineages, it is long, extending about half of the length of valvae (Figs. 218, 225). The vinculum is markedly reduced and inconspicuous. Both fusion bridges give the anterior part of the valvae the appearance of forming a ring.

24. Symmetry of valvae.— The two recognized states are: (1) symmetrical; (2) asymmetrical. Symmetrical valvae are widely distributed in gelechioids and most other Lepidoptera, and are regarded as plesiomorphic. Asymmetry of the valvae occurs in numerous groups of scythridids in various degrees, from slight differences in proportions of the valvae or in shape of lobes or processes to striking differences with valvae completely dissimilar in size and shape; in some groups, such as *Asymmetrura* , each valva is even situated on a different level of the transverse plane of the genitalia. It is likely that asymmetry of the valvae has evolved a number of times within the Scythrididae.

25. Vinculum.— Two states are recognized: (1) saccal region anterior; (2) saccal region caudal. The saccal region here refers to the midventral part of the vinculum. The saccus is typically a process extended cepahalad from that region of the vinculum (Klots 1970). Because a saccus is not differentiated in scythridids, I prefer to designate the region where one would occur as the "saccal region". In state 1, the vinculum is typically formed as a U-shaped band extended across the ventral side, with the saccal region oriented anteriorly or ventro-anteriorly (Figs. 173, 176, 180). This condition is found in most gelechioids which are considered to have relatively primitive male genitalia (Oecophoridae, Blastobasidae, Elachistidae) and in tineoids and yponomeutoids. In scythridids, it occurs only in the genus *Rhamphura* and is regarded as plesiomorphic. In apomorphic state 2, the vinculum has the saccal region oriented caudally or ventro-caudally, suggesting that the structure has undergone a 90°-180° rotation along the longitudinal axis of the genitalia (*e.g.* Fig. 185). This state is probably linked to reduction and fusion of the vinculum with the base of fused valvae, a condition that occurs in many scythridids. Reduction of the vinculum and its incorporation into the fused valvae is so advanced in some scythridids that the vinculum is barely recognizable on the base of valvae and indicated only by a narrow rim delineated by a thin line of fusion (most strikingly observed in members of the *Arotrura* complex, *e.g.* *Meniscotus* , *Mimiella*, *Arotrura* , *Commodes* , *Serangites* — see below). Increased reduction and fusion of the vinculum in scythridids is frequently correlated with increased fusion of the valvae and reduction of their ventral wall. Under state 2, various shapes of vinculum are represented among members of the *Scythris* complex (crescentic, semicircular, or a broad plate of irregular outline, commonly dorsally concave, etc.) but those have not been analysed.

26. Ostium position.— Three states are recognized: (1) on sternum 8 (*e.g.* Figs. 305, 317); (2) on intersegmental membrane between sterna 7 and 8 (*e.g.* Figs. 318-319); (3) on anterior part of sternum 7 (Figs. 322, 324). State 1 is regarded as the plesiomorphic condition because it occurs widely in gelechioids with generalized genitalia (Oecophoridae, Elachistidae) and in other Ditrysia (Common 1970: 772). States 2 and 3 are considered apomorphic. State 2 occurs commonly in scythridids and, in almost all taxa with this condition, the ostium is situated at the apex of a sterigma protruded or projected from the sternal wall. State 3 is found only in the *S. inspersella* and *S. noricella* lineages.

27. Orientation of apex of sterigma.— This character applies to taxa whose ostium is situated at the apex of a projected sterigma. Two states are recognized: (1) oriented caudally or ventro-caudally (*e.g.* Figs. 305, 318); (2) oriented cephalically (Figs. 316, 317, 325). State 1 is considered plesiomorphic because it is the most common condition in sterigma-bearing scythridids and because a ventro-caudally oriented ostium corresponds to the condition found in scythridids and other gelechioids whose ostium is not situated at the apex of a projection. Apomorphic state 2 is found in members of *Rhamphura* and in *Asymmetrura reducta* , whose sterigma is a plate of the sternal wall with a cone projected from its posterior portion and with the ostium-bearing apex pointed towards the anterior part of the abdomen.

28. Size of subapical spurs of tarsomeres 1-4.— The two recognized states are: (1) long; (2) very short. In state 1 (Figs. 79-80), found in almost all scythridids and gelechioids, the spurs of each tarsomere are relatively long, extended over the proximal portion of the following tarsomere and conspicuous even when the scale cover is not removed; this condition is inferred to be plesiomorphic. In apomorphic state 2, the spurs are markedly reduced, barely extended to the apex of tarsomeres (Fig. 81), and inconspicuous. Reduced spurs occur in members of *Areniscythris* and *Neoscythris* .

29. Scales of ventral side of tarsomeres.— Two states are recognized: (1) normal; (2) spiniform. "Normal" (state 1) refers to scales of the ventral side of tarsomere which are not noticeably differentiated in size and shape from those of the dorsal side. This is the common condition in scythridids and other gelechioids and it is inferred to be plesiomorphic. Spiniform scales (state 2) are found only in *Areniscythris* : such scales are markedly elongate relative to scales of the dorsal side of tarsomeres, resembling spines or spurs (Fig. 76), and have thick bases inserted into strikingly enlarged sockets (Fig. 81). Such modified scales likely represent an adaptation for running on sand, a behavior characteristic of members of *Areniscythris* .

30. Shape of head scales.— Two states are recognized: (1) narrow; (2) broad. In state 1, scales of the frons and vertex are very slender, more than 10 times longer than wide (Figs. 65, 69), and rather loosely attached (easily removed with a brush). This type of scales is widespread in scythridids and several gelechioid groups, such as Oecophoridae, Elachistidae, Blastobasidae, and inferred to be plesiomorphic. In state 2, the scales of the frons and vertex are broad, at most five times as long as wide (Fig. 66), and very firmly attached (difficult to remove with a brush or needle). Such scales are characteristic of members of *Areniscythris* and must represent another adaptation of these moths to life on sand dunes, probably as protection against sand abrasion.

Broad scales are found on the frons and vertex in various other gelechioid groups, such as Coleophoridae, Cosmopterigidae, Agonoxenidae, Momphidae, many Gelechiidae, but those differ from the scales of *Areniscythris* in being slender, distally spatulate (Fig. 72) and oriented somewhat transversely in a fan-like arrangement (Fig. 71). It is noteworthy to point out that such variation in shape and pattern of head scales of gelechioids does not seem to be documented in publications, as far as I have been able to ascertain. The head of gelechioid specimens usually is merely characterized as being "smooth-scaled" (*e.g.* Hodges 1978: 5) to indicate that scales are more or less closely appressed instead of being raised or tufted (so-called "rough-scaled"). Shape and pattern of arrangement of head scales may provide useful phylogenetic indicators and warrant further study.

31. Color of scales of wings of females.— Two states are recognized: (1) variously colored and not iridescent; (2) deep indigo-black and markedly iridescent. Even though color of wing scales is greatly varied in scythridids, some specimens have black scales of a very peculiar aspect which differentiates them from all other scales. Such scales, arranged in one or more streaks on the underside of the wings of females, are very deep black and have a strikingly iridescent hue. They are found in the *S. piratica* and *S. anthracina* lineages and are inferred to be apomorphic. All other types of scale color are lumped under state 1, inferred to be plesiomorphic.

Similar black scales are found on the abdomen of females in the *S. anthracina* lineage and one the tergum of females of some *Neoscythris* . Such *Neoscythris* specimens also have iridescent scales on both sides of the hindwings but these are are of a paler, brown tone instead of deep black and are scattered over the surface; this condition probably reflects homoplasy with state 2.

5.3.3 Characters analyzed for relationships within the *Arotrura* complex

All characters described below are part of the highly autapomorphic genitalia of the *Arotrura* complex. Because several of the developments (those of the socii, for example) are unique to the group, polarity of states was inferred largely using ingroup comparisons. The distribution of states of characters 32-47 is given in Table 8.

32. Apex of tergum 8 of males.— Two states are recognized: (1) asetose; (2) setose. State 1 is inferred to be plesiomorphic. It is widespread among members of many genera and here describes a tergum 8 with the apical portion asetose (*e.g.* Fig. 266) or with few scattered setae (*e.g.* Figs. 275, 298). When present, scattered setae most commonly occur along the lateral edges of the tergum (Fig. 293). In apomorphic state 2, the dorsum of the apical portion of tergum 8 is covered with a dense patch of stiff, semi-erect setae which are anteriorly directed (Fig. 302). This state is characteristic of members of *Serangites* .

33. Shape of intersegmental membrane between tergum 8 and tegumen.— Three states are recognized: (1) broad hood; (2) flanged dome; (3) comma-like lobe. State 1 is considered plesiomorphic because it most closely resembles the shape of the unsclerotized membrane found in scythridids of the *Scythris* complex. In this state, the sclerotized membrane merely overlaps part of the genitalia as a broad , somewhat convex plate (*e.g.* Figs. 267, 272, 299). In apomorphic states 2 and 3, the sclerite derived from the membrane is further modified. In state 2, it is markedly sclerotized and forms a markedly convex, ridged, medial dome extended from the posterior edge of the tegumen above the base of socii, with thick lateral flanges produced ventrally and bracing the base of socii (Fig. 277); this condition is found in *Arotrura* . In state 3, a condition characteristic of members of *Commodes* , the sclerite derived from the intersegmental is shaped into a caudally protruded lobe which is somewhat comma-like in lateral aspect (Fig. 294). Possibly either state 2 or 3 is derived from the other, but this is uncertain.

34. Sclerotization of tegumen walls.— There are two recognized states: (1) sclerotized; (2) mostly membranous. In all genera included here but one, as well as in other scythridids, the tegumen is typically formed by two lateral, fully sclerotized walls (called lobes by some authors, *e.g.* Powell 1976) which are joined medio-dorsally. In members of the *Arotrura* complex, the walls are broad, somewhat oval or suborbicular in outline and outwardly convex (*e.g.* Figs. 264, 272, 285, 299). This condition (state 1) is inferred to represent the primitive state. In members of *Hyalinixys* , most of the lateral walls are membranous, sclerotization being reduced to a narrow, U-shaped band lining the anterior margin (Figs. 268-269). This condition (state 2) is inferred to be derived as a result of secondary reduction of the sclerotized area of the tegumen walls.

35. Glanduliform structure inside tegumen.— The two recognized states are: (1) absent; (2) present. The glanduliform structure referred to in state 2 consists of a single, slender, somewhat sausage-like sac extended inside the tegumen of male specimens of *Commodes* (Fig. 294). The sac has transluscent walls with a wrinkled surface (Fig. 297) and is posteriorly tapered to a very narrow duct which seems to exit somewhere between the socii. The external opening of that structure, if it exists, has not been determined because the complex ornamentation and thick sclerotization of the socii obscures the area where the apical part of the duct is located. These glanduliform structures are unique to members of *Commodes* in the *Arotrura* complex and inferred to be autapomorphic.

Structures reminding of glands are also found inside the tegumen and pegged processess of the genitalia of male specimens of *Rhamphura* (see character 16), but they are paired. At present, presence of such structures in both *Commodes* and *Rhamphura* , two unrelated lineages, is best considered homoplastic.

36. Shape of socii.— Two states are recognized: (1) simple (*e.g.* Figs. 264, 269, 272); (2) ornate (*e.g.* Figs. 283, 295, 299). In state 1, the socii are shaped as slender rods, short in some taxa (*Colinita* , *Hyalinixys*), elongate in others (*Meniscotus* , *Arotrura*). Simple socii is considered plesiomorphic based on the assumption that modified, sclerotized socii would be transformed from simple to more complex shapes. At present, there is no evidence to readily suggest that simple socii are the result of secondary reduction. In apomorphic state 2, the modified socii are variously ornamented with lobes, folds, projections or ridges giving them a more complex appearance.

37. Fusion of socii.— Three states are recognized: (1) free (*e.g.* Figs. 273, 278); (2) basally fused and flat (*e.g.* Fig. 283); (3) basally fused and foveate (Fig. 286). The plesiomorphic condition is inferred to be state 1 because free socii, that is socii separate from one another, is common in scythridids and Lepidoptera with such structures. In some members of the *Arotrura* complex, the elongate rods of the modified socii are fused to one another along their median portion (states 2 and 3), the fused portion being extended along a quarter (*Oncoxystus*) (Fig. 290) to almost the entire length of the socii (*Mimiella*) (Fig. 286). In some groups (*Aeciatus* , *Oncoxystus*), the fused region is flat or slightly concave, and smooth (apomorphic state 2). In members of *Mimiella* , the fused region is markedly excavated and the bottom of the concavity appears perforated by several small foveae (state 3). State 3 is possibly a derivative of state 2 in a transformation series.

38. Shape of distal half of socii.— Three states are recognized: (1) simple (*e.g.* Figs. 273, 278); (2) horned (Figs. 282, 285); (3) dilated (Figs. 289, 295, 299). In state 1, the socii are variously tapered and apically rounded or truncate; this condition represents the simplest state and is considered plesiomorphic. In apomorphic state 2, the distal half of each socius bears a dorsal or latero-dorsal spiniform process, which makes the structure appear horned in lateral aspect. This condition is observed in *Mimiella* and in *Aeciatus* . In apomorphic state 3, which occurs in *Oncoxystus* and in members of *Commodes* and *Serangites* , the distal half of socii is variously dilated and/or emarginate or lobate.

39. Distal arm of gnathos.— Two states are recognized: (1) short (*e.g.* Figs. 285, 299); (2) long (Fig. 272). In state one, the distal arm of the gnathos is shorter or subequal in length to the paired proximal arms. This condition is the most common among members of the *Arotrura* complex and is regarded as plesiomorphic. In state 2, the distal arm is about twice as long as the proximal arms; the condition is characteristic of members of *Meniscotus* and inferred to be apomorphic.

40. Position of ankylosis of aedeagus.— Two states are recognized: (1) submedial (*e.g.* Figs. 265, 270); (2) basal (*e.g.* Figs. 279, 285, 289). In state 1, ankylosis is effected by a short, transverse band protruded submedially from the ventral side of the aedeagus and whose opposite apex is more or less rigidly articulated to the medio-anterior edge of the fused valvae. Consequently, the portion of aedeagus cephalad of the ventral band protrudes out of the diaphragma. In state 2, ankylosis is effected by a variously elongate band (*Mimiella* , *Aeciatus* , *Oncoxystus* , *Serangites*) or stiffened anellus (*Arotrura*) which is attached to the anterior end or base of the aedeagus; the diaphragma is extended around the base of the aedeagus so that the whole structure is situated posterad of the diaphragma. The posterior apex of the elongate band (when present) is articulated on the base of the valvae in the same position as the short band of state 1. The position of the aedeagus in relation to the point of ankylosis is considered plesiomorphic in state 1 because it occurs in most scythridids of the *Scythris* lineage and because in other gelechioids with a free aedeagus, a portion of the aedeagus similarly protrudes cephalad of the diaphragma.

Homology of the structures involved in ankylosis is supposed but uncertain. If the short band of state 1 is homologous with the elongate band of state 2, as postulated here, they may represent either a derived manica or a juxta, but correct morphological interpretation of the structures is irrelevant to decision about polarity. If non homologous, however, one state cannot represent a derived condition relative to the other. Consequently, phylogenetic interpretation of this character is tentative.

41. Length of aedeagus.— Two states are recognized: (1) shorter than rest of genitalia; (2) longer than rest of genitalia. State 1 is regarded as plesiomorphic because it is the common condition observed in most members of the *Arotrura* complex and in many other scythridids. In apomorphic state 2, which is characteristic of *Oncoxystus* , the aedeagus is extraordinarily elongate, being more than 1.5 times the length of the rest of genitalia (Figs. 289-290).

42. Fusion bridge of valvae.— Three states are recognized: (1) flat (*e.g.* Fig. 279); (2) broad concavity (Fig. 274); (3) slender concavity (Fig. 291). The fusion bridge is formed by the antero-dorsal wall of the fused valvae which forms a plate protruded cephalad of the ventral wall (the latter is deeply emarginate). In the inferred plesiomorphic condition, the bridge is relatively flat. In apomorphic state 1, the bridge is ventrally inflexed to form a broad, somewhat oval concavity protruded ventrad of the genitalia, the deepest part of which appears lobate in lateral aspect. This state is characteristic of members of *Meniscotus* . In state 2, observed in *Oncoxystus* , the bridge is ventrally inflexed into a slender plate, spear-like in outline.

43. Ornamentation of valvae.— Two states are recognized: (1) without spines; (2) with spines. This character applies only to a peculiar type of spines even though the valvae of many members of the *Arotrura* complex are ornamented with variously shaped lobes. In state 2, which is characteristic of members of *Aeciatus* and inferred to be autapomorphic, each valva is armed with a large, thickly and darkly sclerotized, bifurcate spine situated on the inner side and projected anteriorly (Figs. 282-284). All other members of the complex lack such spines (plesiomorphic state 1).

44. Symmetry of valvae.— The two recognized states are: (1) symmetrical; (2) asymmetrical. Symmetrical valvae are the typical condition in the majority of Lepidoptera, hence state 1 is regarded as plesiomorphic. Asymmetrical valvae occur in various groups in the complex but the plasticity of this apomorphic state in scythridids and its occurrence in several lineages otherwise unrelated on the basis of other characters, suggest that it probably arose several times as a result of convergent or parallel evolution.

45. Surface of sternum 6 of females.— There are two states: (1) without fovea; (2) with fovea. In state 1, inferred to be the plesiomorphic condition, the surface of sternum 6 of females is unmodified. In state 2, characteristic of members of *Serangites* , sternum 6 has a deeply invaginated fovea (Figs. 369-370), whose shape and degree of invagination vary somewhat with the species.

46. Membrane of vestibulum of vagina.— There two recognized states: (1) smooth; (2) finely convoluted. State 1 is present in most members of this complex and all other scythridids and, hence, is regarded as plesiomorphic. State 2 occurs in females of *Oncoxystus* and inferred to be autapomorphic. It describes very fine convolutions or villosities of the wall of the vestibulum, reminding of the inner surface of a mammalian intestine (Fig. 361). At low magnifications, the vagina has a densely papillate appearance (Fig. 397). This state is not an artifact, such as wrinkling, as it might suggest, because the convolutions can be observed in both an inflated and a collapsed vestibulum. In other scythridids, a collapsed vestibulum shows fine wrinkles that have a very different appearance from the convolutions observed in *Oncoxystus* females.

47. Papillae anales.— Two states are recognized: (1) membranous; (2) with sclerotized ridges. State 1 occurs in most members of the *Arotrura* complex and in other scythridids, and is regarded as plesiomorphic. In state 2, the papillae have a pair of prominent, blade-like medial ridges that curve around the apex (Figs. 357-358). This condition is characteristic of members of *Aeciatus* and inferred to be autapomorphic.

5.4 Phylogeny of Nearctic genera and species lineages

In the following discussion, references are made to character and state numbers as decimal figures in brackets, such as they are indicated on the cladograms (Figs. 423-427). The first part of a decimal figure refers to the character number, whereas the second part, after the decimal point, refers to the state number. For example, (20.1) indicates state 1 of character 20. Numbers are defined in the text above and summarized in Tables 6-8.

5.4.1 Phylogeny of major lineages

The cladistic relationship of the major groups of genera and species lineages is depicted in Fig. 423. The two major clades are the *Scythris* complex, whose members share possession of a frenum (8.2), and the *Arotrura* complex, whose members are united by a suite of apomorphic characters of the male and female genitalia, which includes, in males, enlarged, hood-like tergum 8 firmly attached or fused to the tegumen (10.3), extended and sclerotized intersegmental membrane T8-tegumen fused to the tegumen (11.2), elongate and sclerotized socii (12.3), reduced sternum 8 (9.2), and in females, presence of a protruded, membranous lobe on the posterior margin of sternum 7 (13.4) (not included in the cladogram but also probably apomorphic: absence of uncus, wishbone-like gnathos).

The two major complexes differ in significant ways. Monophyly of the *Scythris* complex is based on a single synapomorphy (presence of frenum) and includes lineages that collectively exhibit an extraordinary diversity of forms of genitalia. This is in contrast with the *Arotrura* complex, whose members are united by a common genitalia groundplan. In addition, the *Scythris* complex also includes many (if not most) lineages from all other regions of the world, whereas the *Arotrura* complex appears to be endemic to North America.

Monophyly of the *Arotrura* complex is rather firmly established because it is based on several synapomorphies. Character states of male genitalia indicated on the cladogram are possibly autapomorphic. In females, the protruded membranous lobe of sternum 7 (13.4) is a condition homoplastic with that of the *S. trivinctella* lineage (see Table 6 and Fig. 424).

Monophyly of the *Scythris* complex rests on more tenuous evidence because it is based on a single synapomorphy. The great diversity of genitalia structures exhibited by members of the *Scythris* complex, in contrast to relative uniformity among members of the *Arotrura* complex, suggests that the former clade may not be monophyletic. Also weighting against monophyly of the *Scythris* complex is the fact that the frenum is not a unique feature of the group. A frenum also occurs in the Lecithoceridae and in at least one genus of Gelechiidae (*Physoptila*). Accepting monophyly of the *Scythris* complex means that presence of a frenum in other gelechioids must have been independently derived.

While it is reasonable to assume that possession of a frenum is a derived condition within the Gelechioidea, its occurrence in gelechioid taxa other than the *Scythris* complex suggests alternative hypotheses to the scheme presented above. Three alternative hypotheses are considered here. The first two alternatives are based on the assumption that the frenum is homologous in all taxa that possess it. The third alternative assumes the possibility of a homoplastic frenum, as is assumed in the cladistic hypothesis of Fig. 423.

Alternative hypothesis 1: possession of a frenum is synapomorphic for a clade that includes Lecithoceridae + Scythrididae + Gelechiidae (Fig. 424, a). This implies that the frenum has been secondarily lost in most gelechiids (retained only in *Physoptila*) and in scythridids of the *Arotrura* complex (perhaps also in some lecithocerids —it is not known with certainty whether a frenum is present in all lecithocerids). This alternative necessitates acceptance of monophyly of the gelechiids as they are presently defined. The only convincing synapomorphy defining the Gelechiidae is presence of a so-called radial retinaculum (Braun 1924b, Hodges 1986: 6, Minet 1986), in which the specialized scales of the retinaculum are located on, or anterior to the radius, instead of on the cubitus or between the cubitus and radius as in other gelechioids. If repeated loss of frenum is inferred, then the lecithocerids + scythridids + gelechiids clade could be minimally inclusive, because there would be no reason not to suppose that some other gelechioid groups whose members do not have a frenum also belong to the clade, but have secondarily lost the structure. The consequence is that presence of a frenum would have to be considered as part of the gelechioid groundplan in order to make phylogenetic relationships interpretable, and this is clearly not parsimonious and unsupported by other evidence.

Alternative hypothesis 2: lecithocerids + the *Scythris* complex + *Physoptila* form a monophyletic clade (Fig. 424, b). This implies the assumption that *Physoptila* is not a gelechiid, hence that the radial retinaculum of its members is homoplastic. There is no reason to favor homoplasy of the radial retinaculum, as alternative 2 implies, over homoplasy of the frenum, as the hypothesis of Fig. 423 and alternative 3 (below) imply. Weighting against alternative 2, however, are group trends in genitalia features, which lend additional support to monophyly of the gelechiids (with *Physoptila* included) based on possession of a radial retinaculum (Common 1974: 105)

Alternative hypothesis 3: the *Scythris* complex + lecithocerids form a monophyletic clade, whereas *Physoptila* is a gelechiid whose frenum is indicative of convergence (Fig. 424, c). Thus if the lecithocerids are monophyletic (this is not firmly established), they represent the sister group to the scythridids; if lecithocerids are not monophyletic, then they are paraphyletic to the scythridids.

All three alternative hypotheses imply that presence of a frenum is part of the groundplan of scythridids and, therefore, that monophyly of the *Scythris* complex cannot be upheld. A consequence of this is that part of the *Scythris* complex would be paraphyletic to the *Arotrura* complex and that the genus *Rhamphura* would be the sister group to the rest of the scythridids (Fig. 426); this is discussed further below under phylogeny of the *Scythris* complex. Alternative 3 (Fig. 424, c) is regarded as the most probable one to compete with the hypothesis depicted in

Fig. 423. However, the latter hypothesis, *i.e.* the *Scythris* complex based on presence of a frenum is monophyletic, is tentatively preferred for the admittedly tenuous reasons that occurrence of the frenum in lecithocerids is incompletely known and that no other known character state is known to support a close relationship between lecithocerids and scythridids. Because of the uncertainty in resolution of the basal clades of scythridids and because the cladogram of relationships is based mostly on Nearctic taxa, the *Scythris* complex and the *Arotrura* complex are not given formal names and rank at this point.

5.4.2 Phylogeny of the *Scythris* complex

In the following discussion, as well as in that of the following section (5.4.3), the monophyly of several groups discussed is based on characters that include some that were discussed in the character analysis (presented above) and are indicated on the cladogram, and others that were not. However, some states of unanalyzed characters appear clearly derived and seem to provide excellent apomorphies to define certain lineages. In such instances, these states were mentioned in the discussion as evidence of monophyly, in addition to character states formally analyzed.

Fourteen genera and species lineages are included in the *Scythris* complex, based on possession of a frenum. The distribution of character states of these lineages is given in Table 7 and cladistic relationships among them are depicted in Fig. 425. The cladogram shows two basal clades, the first including only the genus *Rhamphura*, the second including all other groups.

Monophyly of *Rhamphura* is firmly established on the basis of several autapomorphic features of the male genitalia: Y-shaped tergum with apical fan-shaped tuft of modified scales (15.2), markedly sclerotized, transverse sternum 8 with thick inner apodemes (14.4), paired, beak-like processes of latero-posterior margin of tegumen with ventral pegs and inner glanduliform sacs with apical opening (16.2). Additional apomorphies not discussed in the character analysis nor plotted on the cladogram are the peculiar shape of the reduced aedeagus, which is rounded in lateral outline and has a rudder-like ventral process (manica?) attached to the juxta, and the shape of the juxta, which has a medio-posterior protuberance. Other character states, such as lack of uncus and gnathos (17.8, 18.3) and anteriorly projected ostium and sterigma (27.2) are apomorphic but homoplastic because they also occur in other lineages. Loss of gnathos, for example, has also occurred independently in the *S. basilaris* , *S. interrupta* , *S. inspersella* and *S. noricella* lineages, whereas an anteriorly projected sterigma and ostium have been derived independently at least once in *Asymmetrura* (*A. reducta*). Along with strikingly derived features, members of *Rhamphura* retain some very plesiomorphic states within the scythridids, such as a free, U-shaped vinculum with an anteriorly directed saccal region (25.1), and freely articulated valvae that can be expanded laterally (23.1).

The sister group to *Rhamphura* is a large clade that includes all other lineages of the *Scythris* complex and is characterized by a modified vinculum which has the saccal region projected posteriorly (25.2). It is probable that this derived condition is functionally related to the ankylozed or fused condition of the valvae which occurs to various degrees among all members of the complex (23.2, 23.3 — see Table 7), because with the vinculum extended alongside the latero-ventral wall of the valvae, the latter structures can no longer be expanded outward in the transverse plane of the genitalia and are, instead, constrained to move together in the dorso-ventral plane. A possible evolutionary scenario is that ankylosis or fusion of the valvae be viewed as a consequence of the rotation of the vinculum.

The apomorphic condition of the vinculum is also found in all members of the *Arotrura* complex and, under the present scheme of relationships, must be regarded as homoplastic. However, if presence of a frenum was considered plesiomorphic (as in alternative hypothesis 3, presented in section 5.4.1), the *Scythris* complex would no longer be monophyletic, the clade representing the sister group to *Rhamphura* would have to include the *Arotrura* complex and

Rhamphura would be the sister group to that clade (Fig. 426). This large clade would be defined by possession of an apomorphic vinculum (25.2).

Genera and species lineages are easily defined as monophyletic groups within the vinculum-based clade, but relationships among them are very incompletely resolved, as is indicated by the polychotomy of Fig. 425. Probable sister-group relationships of some lineages are indicated but most of these must be regarded as very tentative. Inadequate knowledge of character states and the large number of undescribed and unstudied species groups precludes groupings into more inclusive monophyletic units. Lineages within the polychotomous clade are therefore arranged somewhat linearly on the basis of overall similarity of male genitalia, roughly from those with most plesiomorphic to those with most apomorphic genitalia. Even this arrangement is not entirely rigorous, because evolutionary divergence is so pronounced in so many different ways that any linear arrangement based on overall similarity will be unsatisfactory. Definition and relationships of the lineages are discussed sequentially below.

Scythris s. str. — Monophyly of *Scythris* is supported by three apomorphies, an enlarged, subtriangular sternum 8 with a medio-posterior, bifurcate projection (14.2), horseshoe-shaped uncus (17.2) and elongate juxta attached to the base of aedeagus (21.4). However, this is considered very tenuous because the states occur in other groups as a result of homoplasy. Other than these three synapomorphies, members of *Scythris s. str.* are grouped on the basis of overall similarity in male genitalia, that is, symmetrical genitalia, tegumen deeply V- or U-emarginate dorso-anteriorly and with elongate lateral portions (Figs. 185-188, 193), spear-like or thorn-like gnathos, narrow, tubular and more or less straight aedeagus ankylosed basally, valvae with inner surfaces opposed, at least in basal half, and distinct vinculum. Admittedly, several, if not all, of these shared features are plesiomorphic [shape of the gnathos (20.1), for example, is tentatively hypothesized as the groundplan state for the scythridids], but this is the most that can be suggested at this time to define the genus in a restrictive sense, without undertaking a detailed analysis of the Old World fauna (see section 4.5 about monophyly and relationships of *Scythris*).

S. trivinctella lineage.— This group of species includes two described species, *S. trivinctella* and *S. ypsilon* and a few undescribed species. Members form a monophyletic group from sharing a membranous lobe protruded from the posterior margin of sternum 7 in females (13.4), and a triangular and posteriorly digitate sternum 8 in males (14.3). The enlarged and hood-like tergum 8 males, which together with sternum 8 encloses the genitalia proper (Figs. 197-198, 200-202), and shape of the protrusion at the junction of the proximal arms of the gnathos (Figs. 194-195, 199) are additional probable synapomorphies defining the group. A similar protruded lobe of sternum 7 is found in females of the *Arotrura* complex, but this is interpreted as the result of homoplasy because, in addition to possessing a frenum, members of the *S. trivinctella* lineage also exhibit several discordant character states in male genitalia, which precludes, at this time, their inclusion in the *Arotrura* complex.

S. anthracina lineage.— Monophyly of this lineage is indicated by the following apomorphies: differentiated tergum 8 with spines on the posterior margin (15.4), brace-like uncus (17.5), wings of females with streaks of black, iridescent scales (31.2), and abdomen of females with membranous invaginations filled with deciduous scales (Fig. 327) (the latter not included in the character analysis). *S. anthracina* lineage is hypothesized to be the sister group to the *S. trivinctella* lineage based on the shared derived features of proximal arms of the gnathos with a caudal protusion at their junction (19.4), and distal arm of the gnathos with an apical warped plate (20.8). Presence of streaks of black and iridescent scales on the wings of females also occurs in the *S. piratica* lineage and is inferred to be homoplastic.

S. basilaris lineage.— The characteristic shape of the sternum 7 of males, which has large, pincer-like projections covered on one side with dense villosity (14.5) is inferred to be autapomorphic and to support monophyly of this lineage. The horseshoe-shaped uncus (17.2) is homoplastic with the condition of members of *Scythris*.

S. interrupta lineage.— Monophyly of this lineage is inferred from the apomorphic shape of the sternum 8 of males, which is triangular and posteriorly furcate (14.2), from the dense, preapical tuft of stiff setae of the male valvae (Fig. 211), and the sclerotized and twisted posterior portion of the ductus bursae of females (Fig. 321). Shape of the sternum 8 of males is homoplastic with that of males of *Scythris s. str.* and provides tenuous evidence of monophyly. The other two apomorphies are not discussed in the character analysis but thought to provide good evidence of monophyly.

The *S. interrupta* and *S. basilaris* lineages are inferred to be sister groups based on shared derived features of the male genitalia, notably the elongate juxta basally fused with the valvae and extended dorsally to close the ventral opening of the tegumen (21.2), the elongate, capsular tegumen, and small aedeagus deeply recessed inside the tegumen cavity (Figs. 203-204, 210-211). Members of both lineages have also lost the gnathos (18.3), though this is homoplastic with other groups.

S. inspersella lineage.— Monophyly of *S. inspersella* lineage is best supported by the autapomorphic male genitalia whose tegumen has a large digitate process on the right side, whose characteristically shaped valvae are medially fused by a transverse bridge, and whose juxta has a slender ventral process (Figs. 213-214), and the autapomorphic shape of the female sterigma, which is very large and somewhat asymmetrically finger-shaped (Figs. 324-325). Lack of gnathos (18.3) is assumed to be homoplastic with the condition of the *S. basilaris* + *S. interrupta* clade.

S. noricella lineage.— Monophyly of this lineage is supported by several autapomorphies, notably, in males, the narrow and bi-crescentic sternum 8 (14.6), the elongate flap of tergum 8 (15.3), the autapomorphic, thin and ribbon-like gnathos (20.7), and the huge, characteristically sickle-shaped valvae broadly fused in their basal half (Figs. 218-219), and in females, by the extraordinarily elongate sterigma (Fig. 322). The *S. noricella* lineage is inferred be the sister group to the *S. inspersella* lineage based on enlarged and semi-sclerotized lobes of the socii (12.2), the ring-shaped vinculum (Fig. 219), and the sterigma which is inserted on the anterior portion of sternum 7 (26.3). Other apomorphies, such as lack of uncus (17.8), elongate juxta attached to the base of aedeagus (21.4) and valvae which are fused basally and medially (23.4) also occur in various other lineages as a result of homoplasy.

S. piratica lineage.— The characteristic emargination of the posterior margin sternum 7 of females, which has a pair of globular inner structures (Figs. 328-329) is inferred to support monophyly of this lineage. This is a feature also present in females of closely related, undescribed species. Streaks of black, iridescent scales on the wings (31.2) may indicate a relationship with the *S. anthracina* lineage or with *Neoscythris* , but the marked differences in male genitalia between the latter two groups suggest that such black scales are probably homoplastic (possibly, they are a secondary sexual character because they occur only in females). Male genitalia of undescribed species inferred to be closely related to *S. piratica* differ markedly from those of both *S. anthracina* and *Neoscythris* .

S. inornatella lineage.— Monophyly of this lineage is inferred from the relatively simple distal arm of the gnathos (20.9) with a slight apical dilatation (Fig. 224) and the short, stubby valvae (Fig. 225) fused along their basal half (23.4). The fused condition of the valvae is somewhat similar to that of the *S. noricella* lineage but other features of the genitalia are so dissimilar between the two lineages that state of the valvae is inferred to be the result of homoplasy. The relationships of *S. inornatella*, the only species included in the lineage, are unresolved other than for the fact that members possess a frenum. So far, I have seen no other undescribed, closely related species to help elucidate relationships of *S. inornatella* .

The last four lineages to the right of the cladogram of Fig. 425 (*S. charon* lineage, *Areniscythris* , *Asymmetrura* , *Neoscythris*) are hypothesized to form a monophyletic clade based mainly on two apomorphic features of the gnathos, namely leftward skewing of the proximal arms, with fusion of the left proximal arm to the left latero-posterior edge of the tegumen (18.2), and presence of a caudally or dorso-caudally protruded lobe or process at the base of the left proximal arm (19.2). An additional possible apomorphy is wedging of the distal portion of the aedeagus between the right arm of the gnathos and the base of the right valva, so that it protrudes rightward of the sagittal plane of the genitalia (Figs. 227, 231, 235, 252, 261) (the inferred plesiomorphic condition in scythridids and gelechioids is for the aedeagus to protrude medially, in about the sagittal plane). Also apomorphic, but homoplastic, is the fusion of the base of the valvae (23.3), which occurs in various unrelated lineages. From an evolutionary perspective, it seems that the unique modifications of the gnathos characterizing this clade have led to further, strikingly apomorphic trends such as enlargement of the basal protuberance of the left proximal arm and marked enlargement and/or elongation of the distal arm (*Asymmetrura* , *Neoscythris*) or development of additional lobes on the right proximal arm (*Areniscythris* , *S. charon* lineage).

S. charon lineage.— Monophyly of this lineage is inferred from lack of distal arm of gnathos (20.10), which has been secondarily lost. This condition is, however, convergent with that of at least one species of *Asymmetrura* (*A. reducta*). Additional apomorphies include the characteristic shape of male tergum 8 (Figs. 228-229) and somewhat thick setae of the valvae (Fig. 226).

Areniscythris .— Monophyly of this genus is inferred from the characteristic shape of male tergum 8 (15.5), reduced spurs (28.2) and spiniform scales of tarsomeres 1-4 (29.2), and broad head scales (30.2). Probable additional apomorphies are the pair of characteristically shaped sclerites of the female sternum 8 (left one triangular, right one L-shaped) with the ostium situated on the right sclerite (Fig. 331), and the life habits of both larvae and adults on shifting sand dunes. The sigmoid distal arm of gnathos (20.2) is also a possible apomorphy of *Areniscythris* ; but this is uncertain; it could also be a plesiomorphic feature of the *S. charon* + *Areniscythris* clade (see below) which would have been secondarily lost in the *S. charon* lineage.

The *S. charon* lineage and *Areniscythris* are inferred to be sister groups based on shared derived features of the male genitalia, notably the anteriorly recurved and pointed lobe of the left proximal arm of gnathos (Figs. 227, 231), presence of a lobe on the base of the right proximal arm of gnathos (19.3) and depressed or concave posterior portion of the tegumen with patches of fine setae (Figs. 226-227, 230-231).

Asymmetrura .— Monophyly of this genus is supported by the apomorphic features of the female sternum 7 which has the posterior edge emarginate or cleft with the angles produced into pincer-like projections bracing the sterigma (13.3), and the strikingly enlarged bulbus ejaculatorius of males with a looped ductus ejaculatorius (22.2). These character states provide somewhat tenuous evidence of monophyly, each for a different reason. Regarding the enlarged bulbus ejaculatorius, accepting this state as synapomorphic for the genus requires its secondary reduction in at least *A. reducta* . Regarding sternum 7, females of some *Neoscythris* also have an emarginate or cleft sternum 7, though without the lateral projections, and this could be viewed as a stage in the same transformation series which includes the emargination with pincer projections of members of *Asymmetrura* . Thus *Neoscythris* could be hypothesized to be paraphyletic to *Asymmetrura* , the latter merely being a monophyletic subgroup of the former. However, I have elected to give generic status to both groups because the striking overall dissimilarity in male genitalia of their members would make the genus resulting from their union extremely heterogeneous and rather meaningless in terms of recognition. Members of *Asymmetrura* are also characterized by group trends in male genitalia, notably the strikingly asymmetrical genitalia, subspherical or dome-shaped tegumen, reduction of uncus (17.6, 17.7), and markedly asymmetrical valvae. Members of *Neoscythris* exhibit different group trends (see below). A further potential apomorphy of *Asymmetrura* is that larvae may be leafminers. Such habits characterize larvae of the three species whose immatures have been found (*A. graminivorella* , *A. matutella* , *A. impositella* ; see Chapter 3). However, the larval habits of no species of *Neoscythris* are known, hence the data are insufficient to draw firm conclusions.

Neoscythris .— Monophyly of *Neoscythris* is inferred from the shape of the distal arm of gnathos, which is strikingly elongate, apically hook-like, bent and extended below the ventral plane of the genitalia (20.5), as well as from the reduced spurs of tarsomeres 1-4 (28.2). The former state provides a very characteristic aspect to male genitalia of members of the genus and is hypothesized to be autapomorphic. The second apomorphy, reduction of tarsal spurs, is homoplastic with the condition found in *Areniscythris* . Group trends exhibited by members of *Neoscythris* include differentiation and striking enlargement of the male tergum and sternum 7, enlargement of basal lobe of proximal arm of gnathos, and reduction of valvae. *Neoscythris* and *Asymmetrura* are possibly sister groups, with the conical sterigma of females as possible synapomorphy but, without further evidence, this hypothesis is not accepted at this time, because a conical sterigma is a seemingly homoplastic condition present in various unrelated lineages (*e.g. S. basilaris* , *S. interrupta* , *S. piratica* lineages).

Some character states have such a scattered distribution across taxa that homoplasy is hypothesized to explain their distribution. Such states are not shown on the cladogram for clarity, but their distribution is indicated in Table 7. They include the juxta as a short, medial band (21.3), basally fused valvae (23.3), asymmetrical valvae (24.2), and ostium situated on the intersegmental membrane between S7 and S8 (26.2).

5.4.3 Phylogeny of the *Arotrura* complex

The distribution of states of formally analyzed characters among the nine genera included in the *Arotrura* complex are presented in Table 8 and relationships are depicted in the cladogram of Fig. 427. Members of this complex form a more compact group than those of the *Scythris* complex, and this resulted in fewer states for characters analyzed. Yet, cladistic relationships are not fully resolved, in part because there are many more undescribed forms not belonging to included genera but sharing the synapomorphies of the complex. Additionally, the interpretation of polarity of character states relies largely on ingroup comparisons because many apomorphies defining the genera and indicating relationships among them are based on unique structural transformations (such as those of the elongate and sclerotized socii) within the complex. Where polychotomous branching (indicating uncertainty of relationship) occurred, the classification of genera was derived similarly to that of lineages of the *Scythris* complex.

Colinita .— Monophyly of this genus is inferred from the characteristically shaped sternum 7 of females, which is very elongate, linguiform and encloses the sterigma and ostium between its surface and the base of sternum 8 (Figs. 345-346). Asymmetry of the valvae is also an apomorphic condition (44.2), though homoplastic and present in other genera (*e.g. Hyalinixys*, *Meniscotus*, *Commodes*). Other possible apomorphic features are, in females, the lateral fusion of the anterior margin of tergum 6 with that of sternum 6 (Fig. 344), and, in males, the simple, rod-like valvae (Figs. 264-265), the latter possibly representing a secondary reduction.

Hyalinixys .— Reduction of the lateral walls of the tegumen of males to narrow, C-shaped anterior bands, with the surrounded areas membranous (34.2), and fusion and characteristic shape of sterna 6-8 of females (Figs. 347-348), are inferred to be autapomorphic and to support monophyly of this genus.

Meniscotus .— Monophyly of *Meniscotus* is inferred from the following apomorphies: strikingly elongate and hook-like distal arm of gnathos (39.2), concave dorsal wall of fusion bridge of valvae with a ventral protuberance (42.2), and, possibly, aedeagus with basal crests (Figs. 272, 274). *Meniscotus* , *Hyalinixys* and *Colinita* exhibit plesiomorphic features such as simple, free socii (38.1) and an aedeagus ankylosed submedially (40.1). The only apomorphic character state shared by all three genera is asymmetrical valvae (44.2); however, this state is not regarded as indicative of close relationship among the three genera because it occurs in numerous, otherwise unrelated scythridids not belonging to the complex, and is thus regarded as too homoplastic to be phylogenetically reliable. *Colinita* and *Meniscotus* are possibly sister groups based on the apomorphic condition of the female bursa, which is U-shaped (Figs. 393, 395). However, this hypothesis is not retained on the basis of that single character state, because females of members of undescribed genera, belonging to the *Arotrura* complex but otherwise apparently unrelated to either *Colinita* and *Meniscotus* , also possess a U-shaped bursa; hence the state is probably homoplastic.

The remaining six genera (*Arotrura* , *Aeciatus* , *Mimiella* , *Oncoxystus* , *Commodes* , *Serangites*) are hypothesized to form a monophyletic clade based on the apomorphic condition of the mode of ankylosis of the aedeagus (40.2), formed by the juxta or the anellus which is attached basally, instead of submedially as in the plesiomorphic condition, to the aedeagus. A basally ankylosed aedeagus also occur in some lineages of the *Scythris* complex, such as the *S. inspersella* + *S. noricella* clade and *Scythris s. str.* and this similarity is inferred to be the result of homoplasy.

Arotrura .— Monophyly of *Arotrura* is inferred from the apomorphic shaped of the tergum 8 of males, which has a thick medio-ventral process and has the distal portion laterally compressed and blade-like (Figs. 280-281), the dome-shaped intersegmental membrane between tergum 8 and the tegumen with thick lateral flanges (33.2), and the aedeagus ankylosed by a rigid anellus (Figs. 277, 279). The state of the ankylosed aedeagus is inferred to be the result of secondary reduction of the juxta, so that only the anellus and diaphragma are left to immobilize the aedeagus.

The sister group to *Arotrura* is a clade that includes the five genera to the right of the cladogram in Fig. 425, and is characterized by complex, ornate socii (36.2). Two clades are recognized, albeit based on tenuous evidence, within the monophyletic group characterized by ornate socii, one composed of *Aeciatus* + *Mimiella* , another composed of *Oncoxystus* + *Commodes* + *Serangites* . The *Aeciatus* + *Mimiella* clade is defined by socii that are basally fused (37.2) and distally have spine-like or horn-like projections (38.2). The *Oncoxystus* + *Commodes*

+ *Serangites* clade is defined by socii that are distally variously dilated (38.3), with the three genera arranged in an unresolved trichotomy. The alternative to not using two apomorphic states of the same character to define the above two clades (38.2 vs 38.3) is to have an unresolved polychotomy for all five genera, because no other synapomorphies were found. The hypothesis of the two clades is retained at this time because it provides a better framework of relationships.

Aeciatus .— Monophyly of this genus is supported by at least two autapomorphies, presence of large, furcate spines on the inner wall of the valvae of males (43.2), and sclerotized, blade-like ridges at the apex of the ovipositor of females (47.2). Also probably autapomorphic is the aedeagus with an anchor-like base and with the phallotreme situated on a small ventrally recurved extension (Figs. 283-284), and the characteristic configuration of the sternum 8 of females (Figs. 354-356).

Mimiella .— Monophyly of *Mimiella* is inferred from the following apomorphies: basal part of the socii with a medial concavity with small punctures (37.3), slender aedeagus with a bulbous base (Fig. 285), and, possibly, ostium at apex of projected sterigma (Fig. 353). The latter state, though widespread among various lineages of the *Scythris* complex, appears to be unique within the *Arotrura* complex. Under the present scheme, *Mimiella* is the sister group to *Aeciatus* .

Oncoxystus .— This genus, is defined on the basis of autapomorphic features of the aedeagus, which extraordinarily elongate and distally harpoon-like (41.2), the similarly elongate juxta (Figs. 289-290), concave and spear-like fusion bridge of the dorsal walls of valvae (42.3), shape of sterigma (Fig. 360), and finely convoluted walls of the vestibulum of vagina (46.2). Fusion of the base of socii (37.2) is an apomorphic condition also found in the *Aeciatus* + *Mimiella* clade and is hypothesized to be homoplastic.

Commodes .— Monophyly of *Commodes* is inferred from the presence of a slender, gland-like sac inside the tegumen (35.2), and sclerotized intersegmental membrane T8-tegumen forming a curved, digitate or comma-like lobe extended above the socii (33.3). Asymmetry of valvae (44.2) also occurs in other genera of the complex (*Colinita* , *Hyalinixys* , *Meniscotus* , some species of *Serangites*) and is inferred to be the result of homoplasy.

Serangites .— The presence of a dense patch of stiff and semi-erect setae on the dorso-apical portion of tergum 8 of males (32.2), the elongate, posteriorly bent juxta extended into the upper diaphragma (Fig. 299), and sternum 6 of females with a deeply invaginated fovea (45.2) are apomorphic states supporting the monophyly of *Serangites* . Other possible apomorphies are the elongation of the intersegmental membrane T8-tegumen, which is extended beyond the middle of the male genitalia (Figs. 299-300), and loss of vinculum (or so reduced as to be indistinguishable) (Fig. 301).

5.5 Notes about zoogeography

Any zoogeographic hypothesis about distribution patterns of scythridids would be premature at this time. Among described taxa, many are known from few or unique specimens, or only from the type locality. There are simply too many undescribed and unanalyzed taxa, presently outnumbering described taxa both in North America and in most of the rest of the world, to allow meaningful zoogeographic inferences to be drawn.

Former discussion of the distribution patterns of scythridids has merely been to state that most members of the family occur in the west Palearctic region (*e.g.* Bengtsson 1984: 25). This pattern, however, only reflects collecting bias in that region, as well as a longer history of descriptive work by taxonomists. Extensive study of New World material in the course of this work suggests a different pattern, that is that North America (including Mexico) has the most diverse scythridid fauna, including a large element of endemism, and that the American southwest is center of diversity of the family.

The comparative patterns of diversity of scythridids in other regions of the world remain unknown. It is very strange and suspicious that so few scythridids are known from South America and from the Oriental region. For example, there is a single species of scythridid reported from Japan. In South America, only a dozen species of scythridids have been described, and an additional few dozens undescribed forms have been collected in southern Argentina and Chile. Yet, deserts and other arid habitats, which are so rich in species in North America, have not been collected in South America (V.O. Becker, pers. comm. 1987). Clearly, the family is vastly undercollected in most areas of the world, and this situation, as long as it persists, will remain an obstacle to zoogeographic analysis.

5.6 Concluding remarks

The phylogenetic analysis presented in this chapter is preliminary, and the resulting classification, relatively conservative. Inability to elucidate relationships of many genera and species lineages within both major complexes, and to resolve the several polychotomies in the cladograms, results from wide structural gaps among genera, inadequate knowledge of the distribution of character states and uncertain interpretation of the polarity of many states. Those difficulties stem largely from the unstudied st[illegible] of the numerous undescribed groups, as well as from the extreme degree of structural divergence exhibited by scythridid lineages.

Although rejected in principle (see Chapter 2, section 2.6.3 about criteria for genus recognition), paraphyly will undoubtedly be discovered subsequently among proposed lineages, when character analysis is further refined and more characters are phylogenetically interpreted. It must be kept in mind that classification of the Scythrididae is in its infancy. With undescribed genera and species outnumbering described taxa by about 10 times, any hypothesis of relationships, and classification derived from such inferred relationships, are potentially subject to major subsequent re-arrangements. However, this is an inevitable stage in the history of classification of groups of organisms. One cannot hope to achieve the "best" classification of a group the first time it is attempted. Instead, an initial proposal must be viewed as a working hypothesis to be tested by studying more taxa and characters, and is better than having no hypothesis at all. The generic framework proposed in this thesis was elaborated with this view in mind. It is hoped that this work will stimulate other systematists with a spirit of Linnean adventurism to join in the study of those fascinating scythridid moths.

Table 5. Summary of lineages of Nearctic Scythrididae treated in this work and their included taxa (An asterisk denotes the type species of that genus. Lineages designated by species names have informal status and are used to indicate monophyletic groups not related to *Scythris* in the strict sense nor to other described genera, but provisionally left in *Scythris* until further revised.).

The *Scythris* complex

Genus / lineage	Included species
Rhamphura Landry, new genus	* *R. ochristriata* (Walsingham)
	R. perspicillella (Walsingham)
	R. suffusa (Walsingham)
	R. altisierrae Keifer
	R. immunis Meyrick [Neotropical]
Scythris Hübner (*sensu stricto*)	* *S. limbella* (Fabricius)
	S. immaculatella (Chambers)
	S. mixaula Meyrick
Scythris trivinctella lineage	*S. trivinctella* (Zeller)
	S. ypsilon Braun
Scythris anthracina lineage	*S. anthracina* Braun
Scythris basilaris lineage	*S. basilaris* (Zeller)
	S. eboracensis (Zeller)
Scythris interrupta lineage	*S. interrupta* Braun
Scythris inspersella lineage	*S. inspersella* (Hübner)
Scythris noricella lineage	*S. noricella* (Zeller)
Scythris piratica lineage	*S. piratica* Meyrick
Scythris inornatella lineage	*S. inornatella* (Chambers)
Scythris charon lineage	*S. charon* Meyrick
Areniscythris Powell	* *A. brachypteris* Powell
Asymmetrura Landry, new genus	*A. graminivorella* (Braun)
	A. matutella (Chambers)
	* *A. impositella* (Zeller)
	A. scintillifera (Braun)
	A. reducta (Braun)
Neoscythris Landry, new genus	* *N. fissirostris* (Meyrick)
	N. confinis (Braun)
	N. planipenella (Chambers)

Table 5 (cont.). Summary of lineages of Nearctic Scythrididae treated in this work and their included taxa.

The *Arotrura* complex

Genus	Included species
Colinita Busck	* *C. sponsella* Busck
Hyalinixys Landry, new genus	* *H. sinuosa* Landry, new species
Meniscotus Landry, new genus	* *M. balli* Landry, new species
Arotrura Walsingham	* *A. eburnea* Walsingham
Aeciatus Landry, new genus	* *A. formidabilis* Landry, new species
Mimiella Landry, new genus	* *M. divaricata* (Braun) *M. oxyplecta* (Meyrick)
Oncoxystus Landry, new genus	* *O. longissimus* Landry, new species
Commodes Landry, new genus	* *C. radulatus* Landry, new species
Serangites Landry, new genus	* *S. powelli* Landry, new species

Table 6. Distribution of character states in lineages of Nearctic Scythrididae. Refer to text for explanation of characters and states. Character numbers start at 8. Characters 1-7 are used in discussion of monophyly of the family and are not tabulated because the same states are shared by all Scythrididae. State numbers are indicated in brackets after state names. An asterisk denotes the inferred plesiomorphic state for that character; a question mark indicates that the state is unknown in that taxon; "lin." following a taxon name signifies lineage.

Character	8 Frenum	9 Male S8	10 Male T8	11 ISM T8-tegumen	12 Socii	13 Female S7
Taxon						
Scythris s. str.	present (2)	modified (3)	modified (2)	membranous (1)*	absent (4)	emarginate (2)
S. trivinctella lin.	present (2)	modified (3)	modified (2)	membranous (1)*	absent (4)	lobate (4)
Rhamphura	present (2)	modified (3)	modified (2)	membranous (1)*	absent (4)	entire (1)*
S. basilaris lin.	present (2)	modified (3)	modified (2)	membranous (1)*	membranous (1)*	emarginate (2)
S. interrupta lin.	present (2)	modified (3)	unmodified (1)*	membranous (1)*	membranous (1)*	emarginate (2)
S. inspersella lin.	present (2)	unmodified (1)*	modified (2)	membranous (1)*	enlarged lobes (2)	entire (1)*
S. noricella lin.	present (2)	modified (3)	modified (2)	membranous (1)*	enlarged lobes (2)	entire (1)*
S. piratica lin.	present (2)	?	?	?	?	emarginate (2)
S. anthracina lin.	present (2)	unmodified (1)*	modified (2)	membranous (1)*	absent (4)	emarginate (2)
S. inornatella lin.	present (2)	unmodified (1)*	unmodified (1)*	membranous (1)*	absent (4)	?
S. charon lin.	present (2)	unmodified (1)*	modified (2)	membranous (1)*	absent (4)	?
Areniscythris	present (2)	unmodified (1)*	modified (2)	membranous (1)*	absent (4)	entire (1)*
Asymmetrura	present (2)	unmodified (1)*	unmodified (1)*, modified (2)	membranous (1)*	absent (4)	pincer-like (3)
Neoscythris	present (2)	unmodified (1)*, modified (3)	unmodified (1)*, modified (2)	membranous (1)*	absent (4)	entire (1)*, emarginate (2)
Colinita	absent (1)*	reduced (2)	fused hood (3)	sclerotized (2)	sclerot. rods (3)	lobate (4)
Hyalinixys	absent (1)*	reduced (2)	fused hood (3)	sclerotized (2)	sclerot. rods (3)	lobate (4)
Meniscotus	absent (1)*	reduced (2)	fused hood (3)	sclerotized (2)	sclerot. rods (3)	lobate (4)
Mimiella	absent (1)*	reduced (2)	fused hood (3)	sclerotized (2)	sclerot. rods (3)	lobate (4)
Aeciatus	absent (1)*	reduced (2)	fused hood (3)	sclerotized (2)	sclerot. rods (3)	lobate (4)
Oncoxystus	absent (1)*	reduced (2)	fused hood (3)	sclerotized (2)	sclerot. rods (3)	lobate (4)
Arotrura	absent (1)*	reduced (2)	fused hood (3)	sclerotized (2)	sclerot. rods (3)	lobate (4)
Commodes	absent (1)*	reduced (2)	fused hood (3)	sclerotized (2)	sclerot. rods (3)	lobate (4)
Serangites	absent (1)*	reduced (2)	fused hood (3)	sclerotized (2)	sclerot. rods (3)	lobate (4)

Table 7. Distribution of character states in lineages of the *Scythris* complex. Refer to text for explanation of characters and states. State numbers are indicated in brackets after state names. An asterisk denotes the inferred plesiomorphic state for that character; a question mark indicates that the state is unknown in that taxon; "lin." following a taxon name signifies lineage.

Character Taxon	14 Male S8	15 Male T8	16 Tegumen processes	17 Uncus shape	18 Gnathos position	19 Gnathos proximal arms
Scythris s. str.	triangular-bifurcate (2)	unmodified (1)*, others (6)	absent (1)*	horseshoe (2)	medial (1)*	simple (1)*
S. trivinctella lin.	triangular-digitate (3)	others (6)	absent (1)*	bilobate (3)	medial (1)*	junction protruded (4)
Rhamphura	transverse (4)	Y-shaped (2)	present (2)	absent (8)	absent (3)	(not applicable)
S. basilaris lin.	pincer-like (5)	others (6)	absent (1)*	horseshoe (2)	absent (3)	(not applicable)
S. interrupta lin.	triangular-bifurcate (2)	others (6)	absent (1)*	vestigial (7)	absent (3)	(not applicable)
S. inspersella lin.	others (7)	unmodified (1)*	absent (1)*	absent (8)	absent (3)	(not applicable)
S. noricella lin.	bi-crescentic (6)	elongate flap (3)	absent (1)*	absent (8)	medial (1)*	simple (1)*
S. piratica lin.	?	?	?	?	?	?
S. anthracina lin.	unmodified (1)*	spined (4)	absent (1)*	brace-like (5)	medial (1)*	junction protruded (4)
S. inornatella lin.	unmodified (1)*	unmodified (1)*	absent (1)*	others (9)	medial (1)*	simple (1)*
S. charon lin.	unmodified (1)*	others (6)	absent (1)*	vestigial (7)	left (2)	both arms lobate (2, 3)
Areniscythris	unmodified (1)*	linguiform (5)	absent (1)*	vestigial (7)	left (2)	both arms lobate (2, 3)
Asymmetrura	unmodified (1)*, others (7)	unmodified (1)*	absent (1)*	tooth-like (6), vestigial (7)	left (2)	left arm lobate (2)
Neoscythris	unmodified (1)*, others (7)	unmodified (1)*, others (6)	absent (1)*	digitate (1)*, cylindrical (4), others (9)	left (2)	left arm lobate (2)

Table 7 (cont.). Distribution of character states in lineages of the *Scythris* complex.

Character Taxon	20 Gnathos distal arm	21 Juxta	22 Bulbus ejacul.	23 Valvae fusion	24 Valvae symmetry	25 Vinculum saccal region
Scythris s. str.	thorn-like (1)*	elong., basal band (4)	small (1)*	bas. ankylozed (2)	symmetrical (1)*	caudal (2)
S. trivinctella lin.	apical plate (8)	short, medial band (3)	small (1)*	bas. ankylozed (2)	symmetrical (1)*	caudal (2)
Rhamphura	(not applicable)	broad+free plate (1)*	small (1)*	free (1)*	symmetrical (1)*	anterior (1)*
S. basilaris lin.	(not applicable)	slender+fused plate (2)	small (1)*	bas. fused (3)	symmetrical (1)*	caudal (2)
S. interrupta lin.	(not applicable)	slender+fused plate (2)	small (1)*	bas. fused (3)	symmetrical (1)*	caudal (2)
S. inspersella lin.	(not applicable)	elong., basal band (4)	small (1)*	bas.+med. fused (4)	asymmetrical (2)	caudal (2)
S. noricella lin.	ribbon-like (7)	elong., basal band (4)	small (1)*	bas.+med. fused (4)	symmetrical (1)*	caudal (2)
S. piratica lin.	?	?	?	?	?	?
S. anthracina lin.	apical plate (8)	short, medial band (3)	small (1)*	bas. fused (3)	symmetrical (1)*	caudal (2)
S. inornatella lin.	simple point (9) fused (4)	short, medial band (3) fused (4)	small (1)*	bas.+med.	symmetrical (1)*	caudal (2)
S. charon lin.	absent (10)	short, medial band (3)	small (1)*	bas. fused (3)	symmetrical (1)*	caudal (2)
Areniscythris	sigmoid (2)	short, medial band (3)	small (1)*	bas. fused (3)	symmetrical (1)*	caudal (2)
Asymmetrura	rod (3), clavate (4), membranous (6), absent (10)	short, medial band (3)	small (1)*, large (2)	bas. fused (3)	asymmetrical (2)	caudal (2)
Neoscythris	bent hook (5)	short, medial band (3)	small (1)*	bas. fused (3)	symmetrical (1)*, asymmetrical (2)	caudal (2)

Table 7 (cont.). Distribution of character states in lineages of the *Scythris* complex.

Character Taxon	26 Ostium position	27 Sterigma orientation	28 Tarsomere spurs	29 Tarsomere ventral scales	30 Head scales	31 Wing scale color (females)
Scythris s. str.	on S8 (1)*	caudally (1)*	long (1)*	normal (1)*	narrow (1)*	varied (1)*
S. trivinctella lin.	on S8 (1)*	caudally (1)*	long (1)*	normal (1)*	narrow (1)*	varied (1)*
Rhamphura	on S8 (1)*	cephalically (2)	long (1)*	normal (1)*	narrow (1)*	varied (1)*
S. basilaris lin.	bet. S7-S8 (2)	caudally (1)*	long (1)*	normal (1)*	narrow (1)*	varied (1)*
S. interrupta lin.	on S8 (1)*	caudally (1)*	long (1)*	normal (1)*	narrow (1)*	varied (1)*
S. inspersella lin.	on S7 (3)	caudally (1)*	long (1)*	normal (1)*	narrow (1)*	varied (1)*
S. noricella lin.	on S7 (3)	caudally (1)*	long (1)*	normal (1)*	narrow (1)*	varied (1)*
S. piratica lin.	bet. S7-S8 (2)	caudally (1)*	long (1)*	normal (1)	narrow (1)*	black (2)
S. anthracina lin.	bet. S7-S8 (2)	caudally (1)*	long (1)*	normal (1)*	narrow (1)*	black (2)
S. inornatella lin.	?	?	long (1)*	normal (1)*	narrow (1)*	varied (1)*
S. charon lin.	?	?	long (1)*	normal (1)*	narrow (1)*	varied (1)*
Areniscythris	on S8 (1)*	caudally (1)*	very short (2)	spiniform (2)	broad (2)	varied (1)*
Asymmetrura	bet. S7-S8 (2)	caudally (1)*, cephalically (2)	long (1)*	normal (1)*	narrow (1)*	varied (1)*
Neoscythris	on S8 (1)*, bet. S7-S8 (2)	caudally (1)*	very short (2)	normal (1)*	narrow (1)*	varied (1)*

Table 8. Distribution of character states in genera of the *Arotrura* complex. Refer to text for explanation of characters and states. State numbers are indicated in brackets after state names. An asterisk denotes the inferred plesiomorphic state for that character.

Character Taxon	32 Male T8 apex	33 ISM T8-tegumen	34 Tegumen walls	35 Tegumen "gland"	36 Socii shape	37 Socii fusion
Colinita	asetose (1)*	broad hood (1)*	sclerotized (1)*	absent (1)*	simple (1)*	free (1)*
Hyalinixys	asetose (1)*	broad hood (1)*	membranous (2)	absent (1)*	simple (1)*	free (1)*
Meniscotus	asetose (1)*	broad hood (1)*	sclerotized (1)*	absent (1)*	simple (1)*	free (1)*
Mimiella	asetose (1)*	broad hood (1)*	sclerotized (1)*	absent (1)*	ornate (2)	fused+foveate (3)
Aeciatus	asetose (1)*	broad hood (1)*	sclerotized (1)*	absent (1)*	ornate (2)	fused+flat (2)
Oncoxystus	asetose (1)*	broad hood (1)*	sclerotized (1)*	absent (1)*	ornate (2)	fused+flat (2)
Arotrura	asetose (1)*	flanged dome (2)	sclerotized (1)*	absent (1)*	simple (1)*	free (1)*
Commodes	asetose (1)*	comma-like lobe (3)	sclerotized (1)*	present (2)	ornate (2)	free (1)*
Serangites	setose (2)	broad hood (1)*	sclerotized (1)*	absent (1)*	ornate (2)	free (1)*

Table 8 (cont.). Distribution of character states in genera of the *Arotrura* complex.

Character Taxon	38 Socii distal half	39 Gnathos distal arm	40 Aedeagus ankylosis	41 Aedeagus length	42 Valvae fusion bridge	43 Valvae ornamentation
Colinita	simple (1)*	short (1)*	submedial (1)*	short (1)*	flat (1)*	without spines (1)*
Hyalinixys	simple (1)*	short (1)*	submedial (1)*	short (1)*	flat (1)*	without spines (1)*
Meniscotus	simple (1)*	long (2)	submedial (1)*	short (1)*	broad. concave (2)	without spines (1)*
Mimiella	horned (2)	short (1)*	basal (2)	short (1)*	flat (1)*	without spines (1)*
Aeciatus	horned (2)	short (1)*	basal (2)	short (1)*	flat (1)*	with spines
Oncoxystus	dilated (3)	short (1)*	basal (2)	long (2)	narrow. concave (3)	without spines (1)*
Arotrura	simple (1)*	short (1)*	basal (2)	short (1)*	flat (1)*	without spines (1)*
Commodes	dilated (3)	short (1)*	basal (2)	short (1)*	flat (1)*	without spines (1)*
Serangites	dilated (3)	short (1)*	basal (2)	short (1)*	flat (1)*	without spines (1)*

Table 8 (cont.). Distribution of character states in genera of the *Arotrura* complex.

Character Taxon	44 Valvae symmetry	45 Female S6 surface	46 Vagina membrane	47 Papillae anales
Colinita	asymmetrical (2)	without fovea (1)*	smooth (1)*	without ridges (1)*
Hyalinixys	asymmetrical (2)	without fovea (1)*	smooth (1)*	without ridges (1)*
Meniscotus	asymmetrical (2)	without fovea (1)*	smooth (1)*	without ridges (1)*
Mimiella	symmetrical (1)*	without fovea (1)*	smooth (1)*	without ridges (1)*
Aeciatus	symmetrical (1)*	without fovea (1)*	smooth (1)*	with ridges (2)
Oncoxystus	symmetrical (1)*	without fovea (1)*	convoluted (2)	without ridges (1)*
Arotrura	symmetrical (1)*	without fovea (1)*	smooth (1)*	without ridges (1)*
Commodes	asymmetrical (2)	without fovea (1)*	smooth (1)*	without ridges (1)*
Serangites	symmetrical (1)*, asymmetrical (2)	foveate (2)	smooth (1)*	without ridges (1)*

Figures 1 to 8. Dorsal habitus of adult scythridids, wings spread.

Figure 1. *Scythris limbella* (Hübner), female, Ithaca, Tompkins Co., New York.

Figure 2. *Scythris limbella* (Hübner), male, Ithaca, Tompkins Co., New York.

Figure 3. *Scythris mixaula* Meyrick, male, Zapata Ranch, 7900 ft., Alamosa Co., Colorado.

Figure 4. *Scythris mixaula* Meyrick, female, Duval Mine, 3600 ft., Sierrita Mts., Pima Co., Arizona.

Figure 5. *Scythris mixaula* Meyrick, male, Zapata Ranch, 7900 ft., Alamosa Co., Colorado.

Figure 6. *Scythris mixaula* Meyrick, female,Superior, Pinal Co., Arizona.

Figure 7. *Scythris immaculatella* (Chambers), male, Waterton Lakes, Waterton Lakes National Park, Alberta.

Figure 8. *Scythris inspersella* (Hübner), female, Alberton, Prince Edward Island.

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Figures 9 to 16. Dorsal habitus of adult scythridids, wings spread.

Figure 9. *Scythris trivinctella* (Zeller), female, Welder Wildlife Refuge, 8 mi. northeast Sinton, San Patricio Co., Texas.

Figure 10. *Scythris trivinctella* (Zeller), male, Seton Lake, near Lillooet, British Columbia.

Figure 11. *Scythris trivinctella* (Zeller), male, Welder Wildlife Refuge, 8 mi. northeast Sinton, San Patricio Co., Texas.

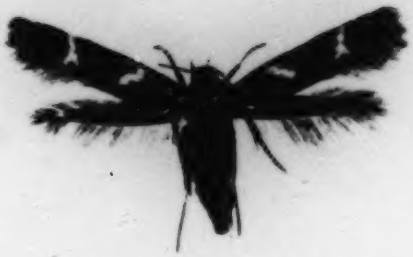
Figure 12. *Scythris trivinctella* (Zeller), male, Everglades, Florida.

Figure 13. *Scythris trivinctella* (Zeller), male, Putnam, Co., Illinois.

Figure 14. *Scythris trivinctella* (Zeller), male, Putnam Co., Illinois.

Figure 15. *Scythris ypsilon* Braun, female, Ciervo Hills, 18 air mi. southwest Mendota, Fresno Co., California.

Figure 16. *Scythris ypsilon* Braun, female, Jacalitos Canyon, Fresno Co., California.



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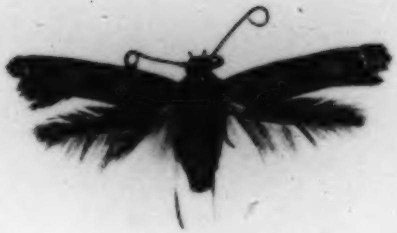

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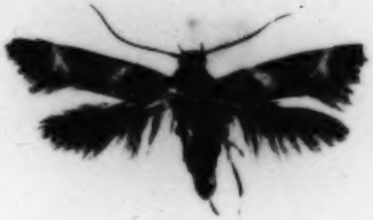

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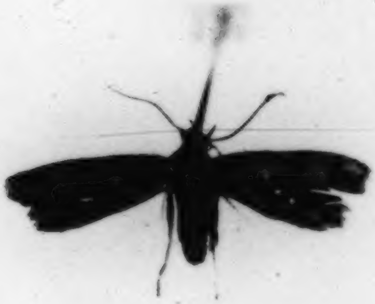

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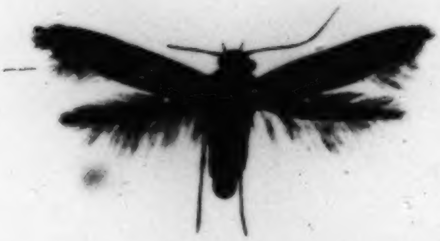

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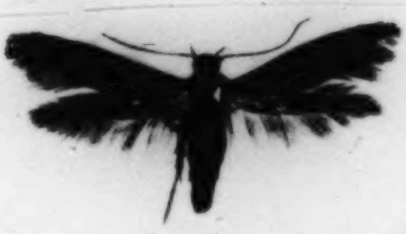

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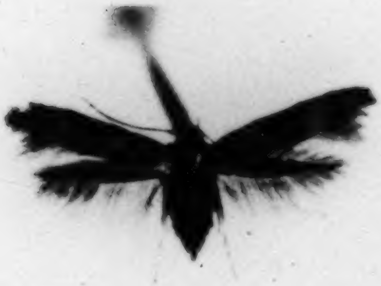

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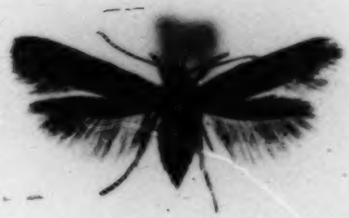

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Figures 17 to 24. Dorsal habitus of adult scythridids, wings spread (except Figs. 22-24).

Figure 17. *Scythris basilaris* (Zeller), female, Cincinnati, Hamilton Co., Ohio.

Figure 18. *Scythris eboracensis* (Zeller), female, Starkville, Oktibbeha Co., Mississippi.

Figure 19. *Scythris* undescribed species near *S. eboracensis* (Zeller), male, Dripping Springs, Mt. Magazine, Logan Co., Arkansas.

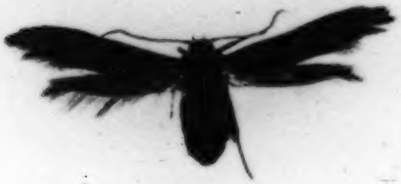
Figure 20. *Scythris interrupta* Braun, female paratype, City Creek Canyon, Highland, San Bernardino Co., California.

Figure 21. *Scythris charon* Meyrick, male paralectotype, Southern Pines, Moore Co., South Carolina.

Figure 22. *Areniscythris* undescribed species 195, female, sand dunes 6 km north Burstall, Saskatchewan.

Figure 23. *Areniscythris brachypteris* Powell, male paratype, Dune Lakes, 3 mi. south Oceano, San Luis Obispo Co., California.

Figure 24. *Areniscythris* undescribed species 195, female, sand dunes 6 km north Burstall, Saskatchewan.



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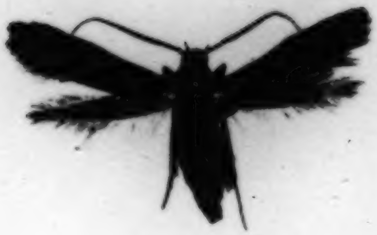

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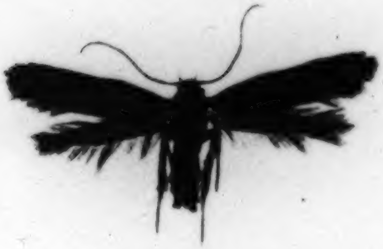

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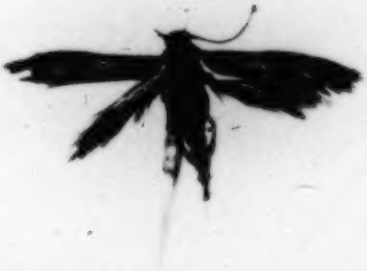

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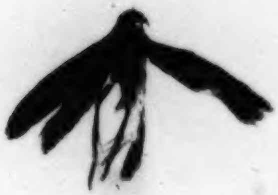

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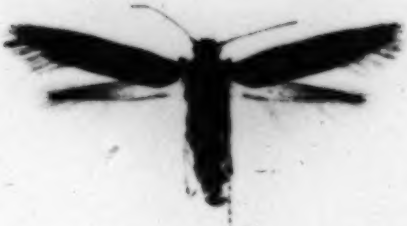

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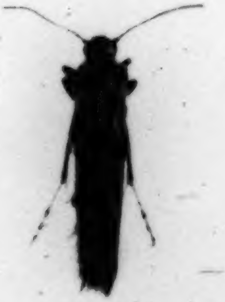

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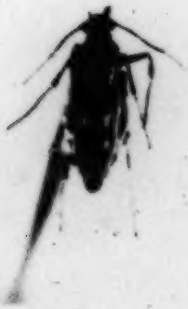

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Figures 25 to 32. Dorsal habitus of adult scythridids, wings spread.

Figure 25. *Scythris anthracina* Braun, male, Sierra Diablo, 6000 ft., 20 mi. northwest Van Horn, Culberson Co., Texas.

Figure 26. *Scythris anthracina* Braun, female, 14 mi. northwest Glamis, Imperial Co., California.

Figure 27. *Rhamphura ochristriata* (Walsingham), male, Antioch National Wildlife Preserve, Contra Costa Co., California, 28 August 1981.

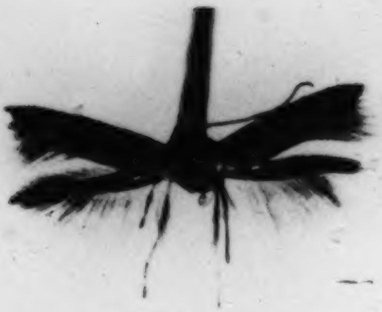
Figure 28. *Rhamphura ochristriata* (Walsingham), male, Antioch National Wildlife Preserve, Contra Costa Co., California, 14 April 1981.

Figure 29. *Rhamphura suffusa* (Walsingham), male paratype, Mt. Shasta, Siskiyou Co., California.

Figure 30. *Rhamphura suffusa* (Walsingham), male paratype, Mt. Shasta, Siskiyou Co., California.

Figure 31. *Rhamphura perspicillella* (Walsingham), male holotype, Folsom Sacramento Co., California.

Figure 32. *Rhamphura altisierrae* (Keifer), female paratype, Ebbetts Pass, Alpine Co., California.



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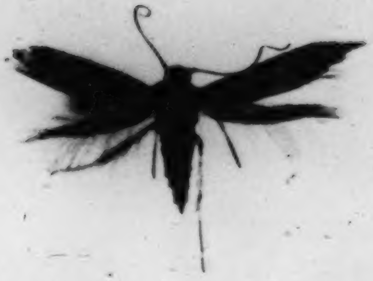

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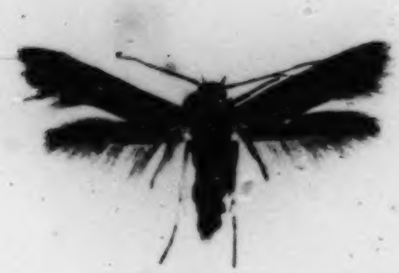

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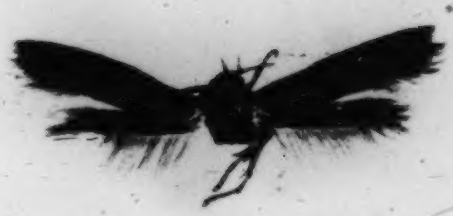

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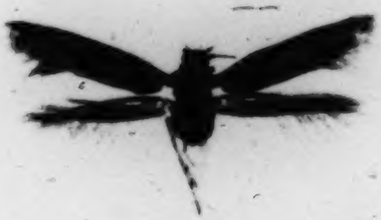

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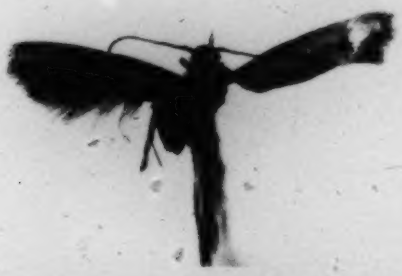

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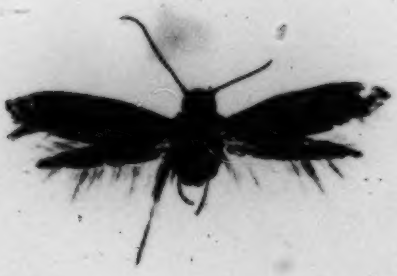

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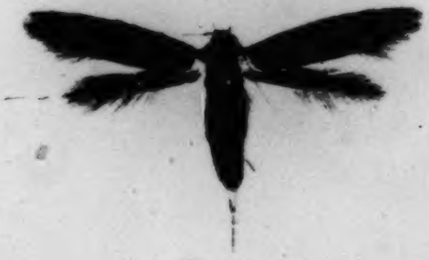

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Figures 33 to 40. Dorsal habitus of adult scythridids, wings spread.

Figure 33. *Neoscythris fissirostris* (Meyrick), male, McKittrick Canyon, 5000 ft., Guadalupe Mts, Culberson Co., Texas.

Figure 34. *Neoscythris fissirostris* (Meyrick), male, K-Bar Ranch, 3400 ft. Chisos Mts., Brewster Co., Texas.

Figure 35. *Neoscythris confinis* (Braun), male, Northern California Coast Range Preserve, 5 mi. north Branscomb, Mendocino Co., California.

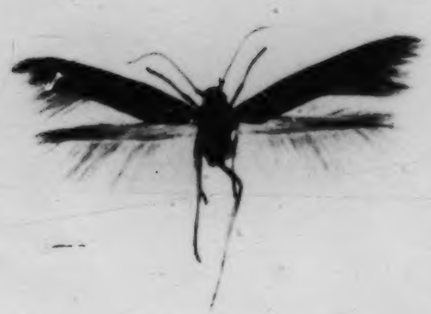
Figure 36. *Neoscythris* undescribed species 166, female, 10 mi. north Hermosillo, 1000 ft., Sinaloa, México.

Figure 37. *Asymmetrura reducta* (Braun), female paratype, Olancha, Inyo Co., California.

Figure 38. *Asymmetrura scintillifera* (Braun), male, Lost River Valley, 10 km south Onefour, Alberta.

Figure 39. *Asymmetrura graminivorella* (Braun), female paratype, Cincinnati, Hamilton Co., Ohio.

Figure 40. *Asymmetrura matutella* (Clemens), female, Pines, Porter Co., Indiana.



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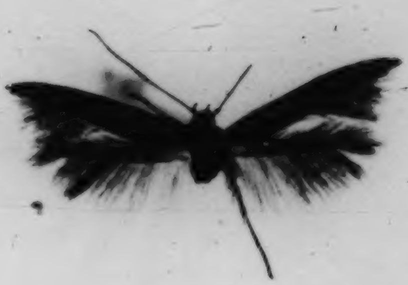

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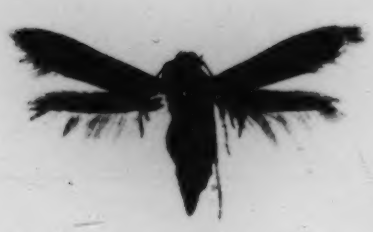

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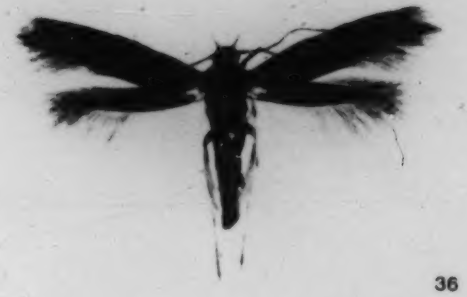

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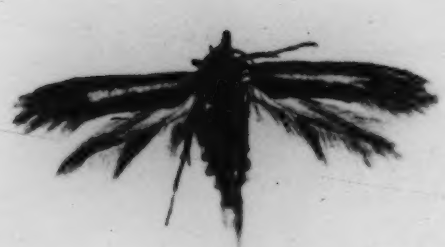

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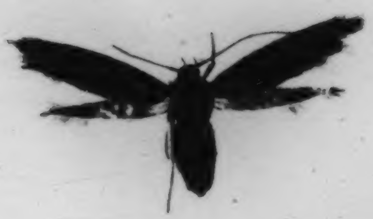

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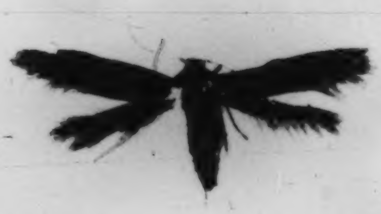

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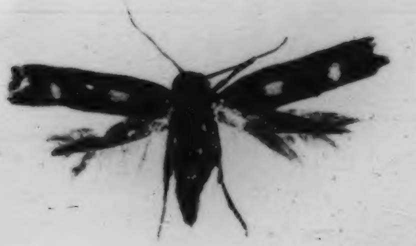

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Figures 41 to 48. Dorsal habitus of adult scythridids, wings spread.

Figure 41. *Asymmetrura matutella* (Clemens), female, Pittsburgh, Allegheny Co., Pennsylvania.

Figure 42. *Asymmetrura matutella* (Clemens), female, Brown Spring, Mt. Magazine, Logan Co., Arkansas.

Figure 43. *Asymmetrura matutella* (Clemens), male, New Brighton, Beaver Co., Pennsylvania.

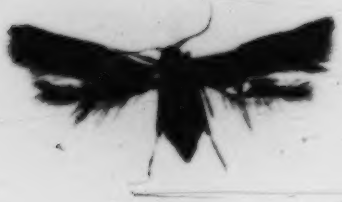
Figure 44. *Asymmetrura matutella* (Clemens), male, Hartford, Sebastian Co., Arkansas.

Figure 45. *Asymmetrura impositella* (Zeller), male, Ottawa, Ontario.

Figure 46. *Asymmetrura impositella* (Zeller), male, Cincinnati, Hamilton Co., Ohio.

Figure 47. *Asymmetrura impositella* (Zeller), female, Whitemud Creek, Edmonton, Alberta.

Figure 48. *Asymmetrura impositella* (Zeller), male, Ottawa, Ontario, Canada.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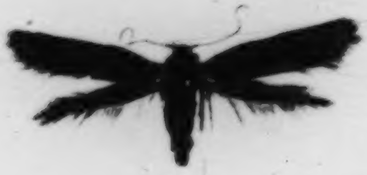
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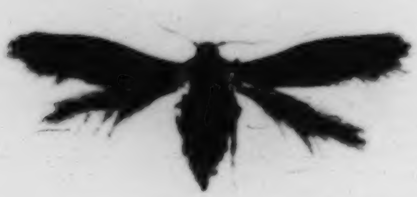
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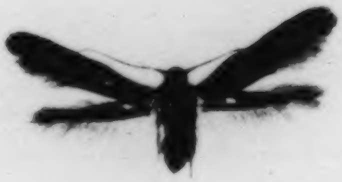
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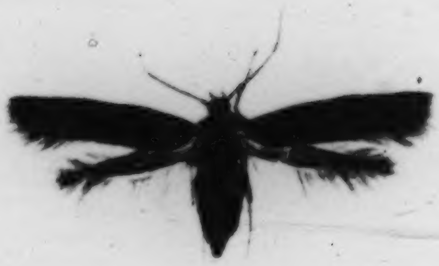
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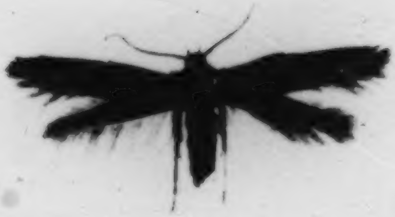
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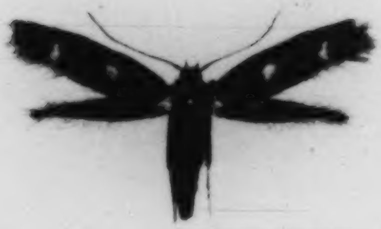
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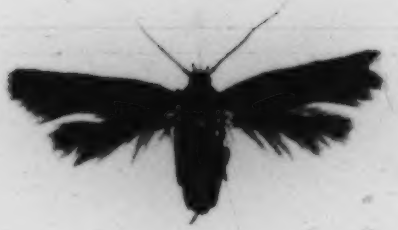
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Figures 49 to 56. Dorsal habitus of adult scythridids, wings spread.

Figure 49. *Arotrura eburnea* Walsingham, female, Prescott, Yavapai Co., Arizona (dark spot on left forewing is a rubbed mark).

Figure 50. *Arotrura eburnea* Walsingham, female, 8 mi. north Bridgeport, Yavapai Co., Arizona.

Figure 51. *Aeciatus formidabilis* Landry, new species, male paratype, Kingman, Mohave Co., Arizona.

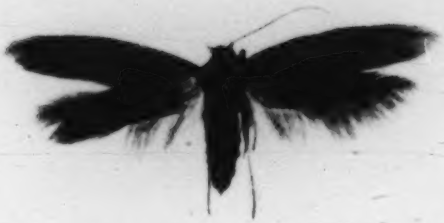
Figure 52. *Colinita sponsella* Busck, male, Ord Mountain, San Bernardino Co., California.

Figure 53. *Mimiella divaricata* (Braun), female, Fort Valley, 7350 ft., 7.5 mi. northwest Flagstaff, Coconino Co., Arizona.

Figure 54. *Mimiella divaricata* (Braun), male, Jacalitos Canyon, 6 mi. south Coalinga, Fresno Co., California.

Figure 55. *Scythris noricella* (Zeller), male, Hope Summit, near Hope, British Columbia.

Figure 56. *Scythris noricella* (Zeller), female, Keen Creek, near Kaslo, Kootenay District, British Columbia.



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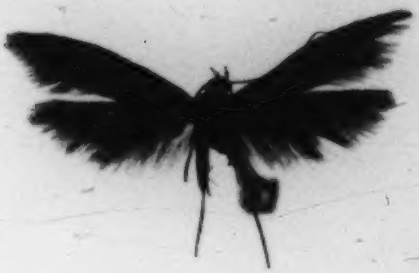

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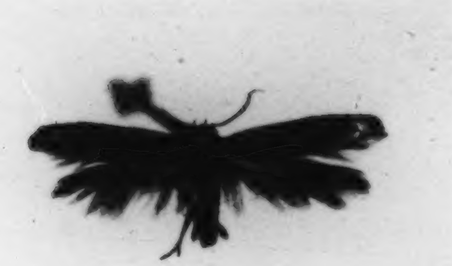

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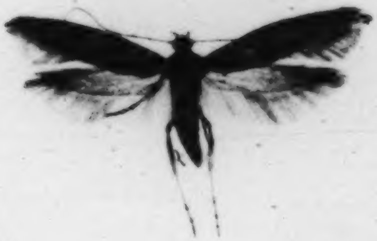

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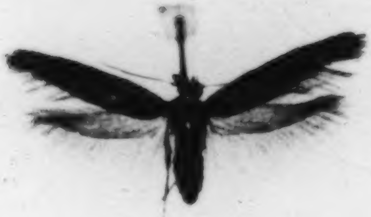

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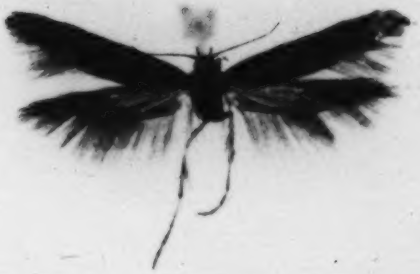

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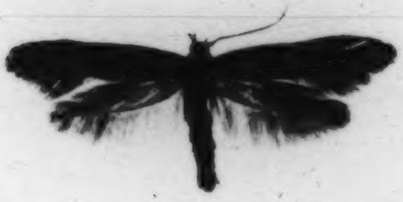

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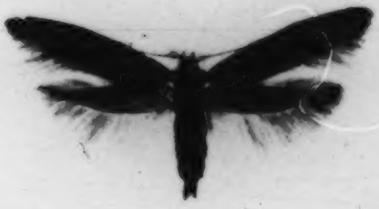

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Figures 57 to 64. Dorsal habitus of adult scythridids, wings spread.

Figure 57. *Oncoxystus longissimus* Landry, new species, male holotype, West Cove, San Clemente Island, Los Angeles Co., California.

Figure 58. *Oncoxystus longissimus* Landry, new species, male paratype, Sierra Diablo, 6000 ft., 20 mi. northwest Van Horn, Culberson Co., Texas.

Figure 59. *Meniscotus balli* Landry, new species, male paratype, Palm Canyon, Kofa Mts., Yma Co., Arizona.

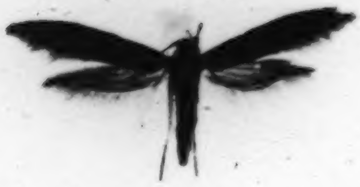
Figure 60. *Meniscotus balli* Landry, new species, male paratype, 10 mi. north Earp, San Bernardino Co., California.

Figure 61. *Hyalinixys sinuosa* Landry, new species, male holotype, La Jolla, San Diego Co., California.

Figure 62. *Commodes radulatus* Landry, new species, male holotype, Laguna Atascosa, Cameron Co., Texas.

Figure 63. *Serangites powelli* Landry, new species, male paratype, 1 mi. north Alpine Lake, Marin Co., California.

Figure 64. *Serangites powelli* Landry, new species, male paratype, same data as Fig. 63.



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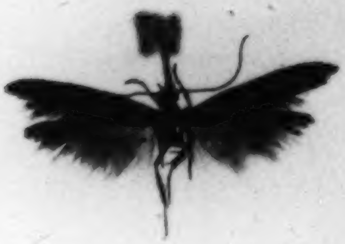

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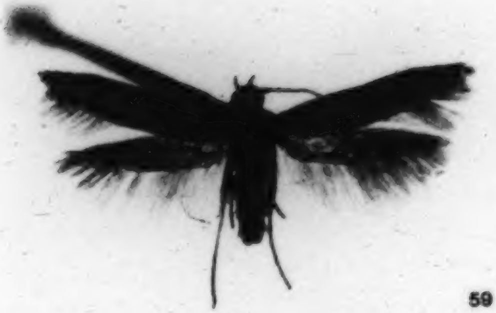

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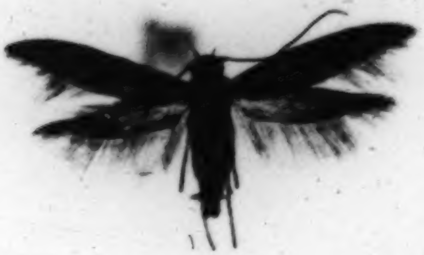

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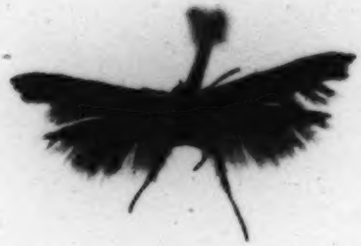

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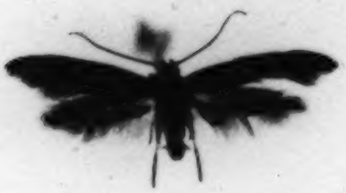

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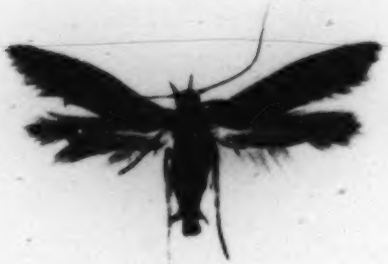

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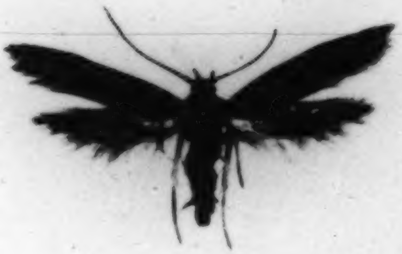

64

Figures 65 to 72. Comparison of heads and scalation.

Figure 65. Frontal aspect of head of *Asymmetrura* undescribed species 30 from Alberta, with narrow scales.

Figure 66. Frontal aspect of head of *Areniscythris* undescribed species 195 from Saskatchewan, with broad scales.

Figure 67. Lateral aspect of head of *Oncoxystus longissimus* , with long, upcurved labial palpi extended to level of vertex and with large eye.

Figure 68. Lateral aspect of head of *Areniscythris* undescribed species 195 from Saskatchewan, with short labial palpi extended to middle of frons and eye posteriorly bordered by wide gena.

Figure 69. Frontal aspect of head of *Oncoxystus longissimus* , illustrating narrow frontal scales and third articles of labial palpi parallel.

Figure 70. Frontal scales of *Oncoxystus longissimus* , illustrating enlarged view of narrow scales.

Figure 71. Antero-dorsal aspect of head of *Coleophora trifolii* (Coleophoridae), illustrating spatulate scales in fan-like arrangement.

Figure 72. Vertex scales of *Coleophora trifolii* (Coleophoridae), illustrating enlarged view of spatulate scales.

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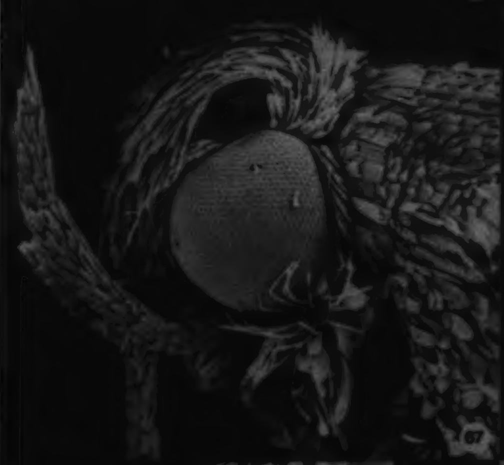
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Figures 73 to 78. Structures of *Areniscythris* undescribed species 195 from Saskatchewan.

Figure 73. Lateral aspect of metathoracic furca.

Figure 74. Dorsal aspect of metathoracic furca.

Figure 75. Inner side of denuded apical portion of foretibia and basal portion of first tarsomere, illustrating spiniform apex of tibia and epiphysis.

Figure 76. Hind tarsus, illustrating spiniform ventral scales.

Figure 77. Lateral aspect of denuded vertex, illustrating corrugated cuticle.

Figure 78. Frontal aspect of clypeal region, illustrating labrum with pilifers, maxillary palpi and base of haustellum.

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Figures 79 to 82. Comparison of denuded apical portion of tarsomere (ventral aspect).

Figure 79. *Asymmetrura* undescribed species 30 from Alberta, with two large subapical spurs and small sockets of normal scales.

Figure 80. *Scythris laminella* (from Europe), with two large subapical spurs and pre-apical spur.

Figure 81. *Areniscythris* undescribed species 195 from Saskatchewan, with two reduced subapical spurs and very large sockets of spiniform scales.

Figure 82. *Antaeotricha schlaegeri* (Oecophoridae), with three large subapical spurs.

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Figures 83 to 85. Structure of male genitalia of *Rhamphura* undescribed species 224 from California.

Figure 83. Caudal aspect of beak-like processes of tegumen, showing orifices of glanduliform structures. The plate with a medial, rugulose protuberance ventrad of the processes is the juxta.

Figure 84. Lateral oblique aspect of beak-like processes, showing ventral clusters of pegs. The large protuberance ventrad of the processes is the juxta.

Figure 85. Enlarged view of ventral pegs of beak-like process of tegumen.

Figures 86 to 88. Structure of male genitalia of *Asymmetrura impositella* .

Figure 86. Caudal aspect of whole genitalia.

Figure 87. Dorsal aspect of whole genitalia.

Figure 88. Lateral aspect of basal lobe of left proximal arm of gnathos, showing scale-like microsculpture.

Figures 89 to 90. Structure of male genitalia of *Areniscythris* undescribed species 195 from Saskatchewan.

Figure 89. Caudal oblique aspect of whole genitalia.

Figure 90. Lateral aspect of basal lobe of left proximal arm of gnathos, showing spiniform microsculpture.

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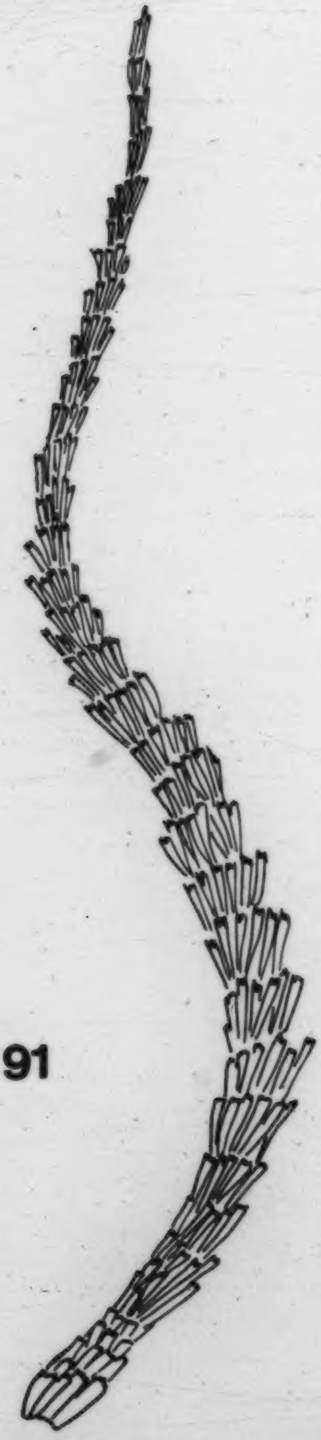
Figures 91 to 92. Comparison of antenna. Scale bar = 0.5 mm.

Figure 91. *Scythris eboracensis* .

Figure 92. *Scythris* undescribed species 17 (near *S. eboracensis*).



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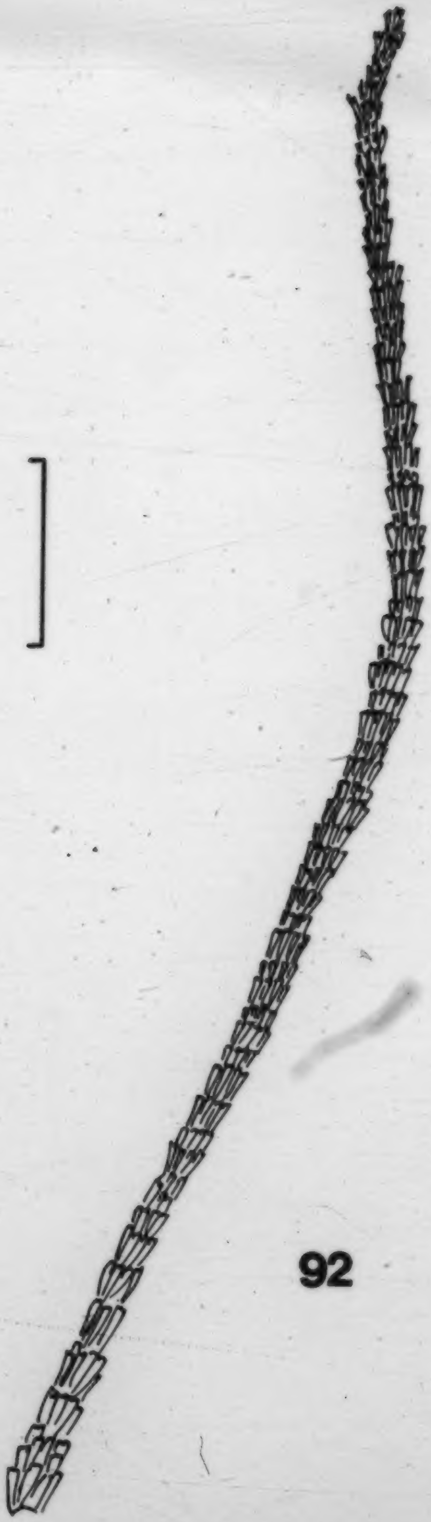
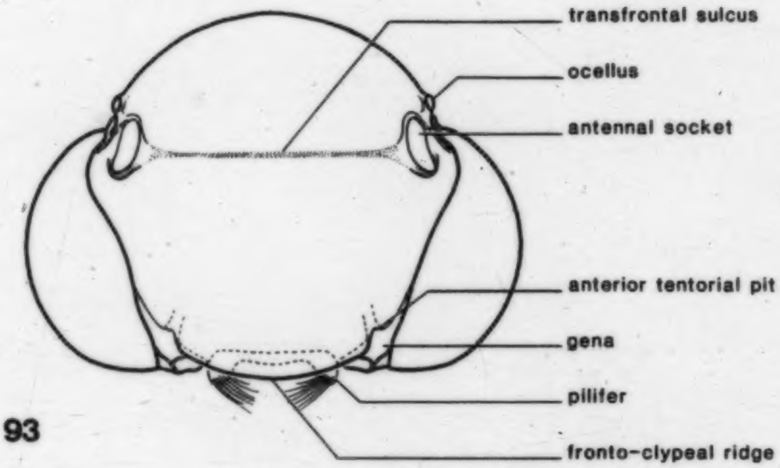


92

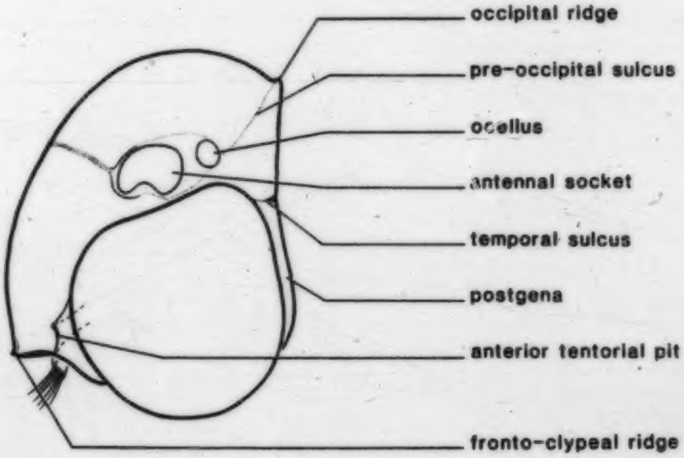
Figures 93 to 94. Denuded head of imaginary scythridid, illustrating structures and terms; mouthparts and antennae omitted.

Figure 93. Frontal aspect.

Figure 94. Lateral aspect.


transfrontal sulcus
ocellus
antennal socket
anterior tentorial pit
gena
pilifer
fronto-clypeal ridge

93


occipital ridge
pre-occipital sulcus
ocellus
antennal socket
temporal sulcus
postgena
anterior tentorial pit
fronto-clypeal ridge

94

Figures 95 to 97. Comparison of denuded heads (mouthparts and antennae omitted) and of palpi scythridids; (a) head, frontal aspect; (b) head, lateral aspect; (c) labial palp, lateral aspect; (d) maxillary palp, frontal aspect.

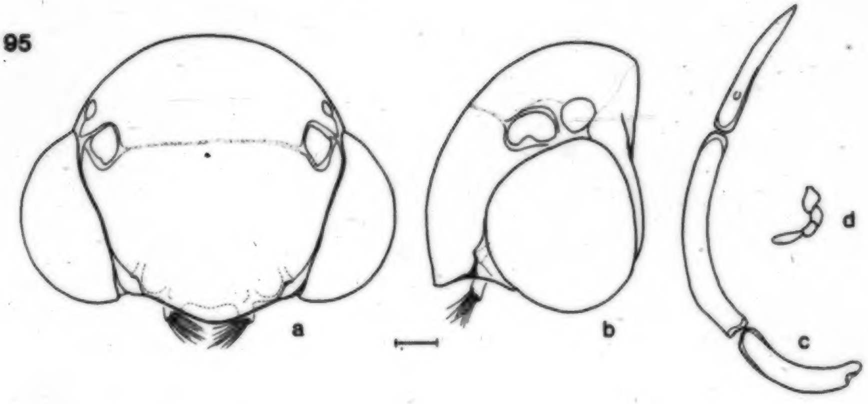
Scale bars = 0.1 mm.

Figure 95. *Scythris limbella* .

Figure 96. *Scythris trivinctella* .

Figure 97. *Scythris mixaula* .

95



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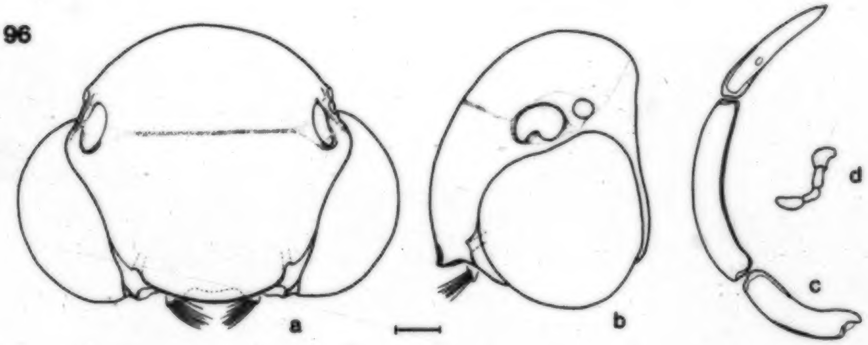

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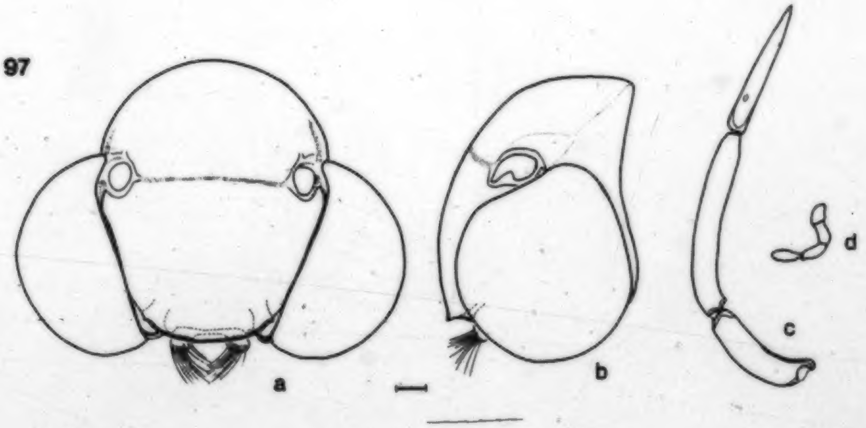


Figures 98 to 100. Comparison of denuded heads (mouthparts and antennae omitted) and of palpi scythridids; (a) head, frontal aspect; (b) head, lateral aspect; (c) labial palp, lateral aspect; (d) maxillary palp, frontal aspect.

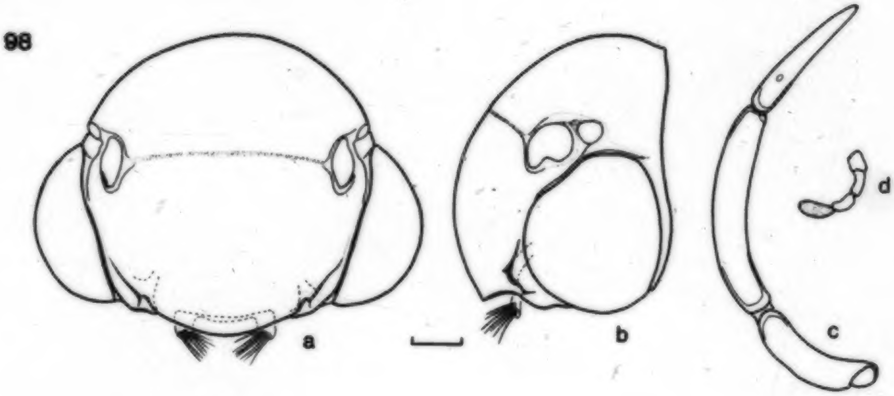
Scale bars = 0.1 mm.

Figure 98. *Rhamphura* undescribed species 224.

Figure 99. *Asymmetrura impositella* .

Figure 100. *Asymmetrura* undescribed species 138.

98



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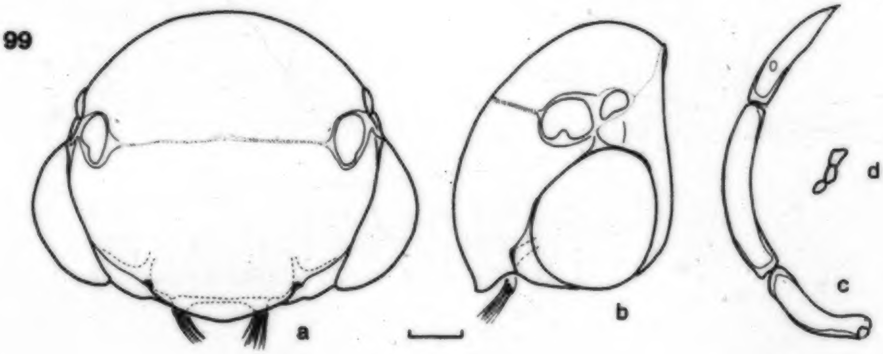

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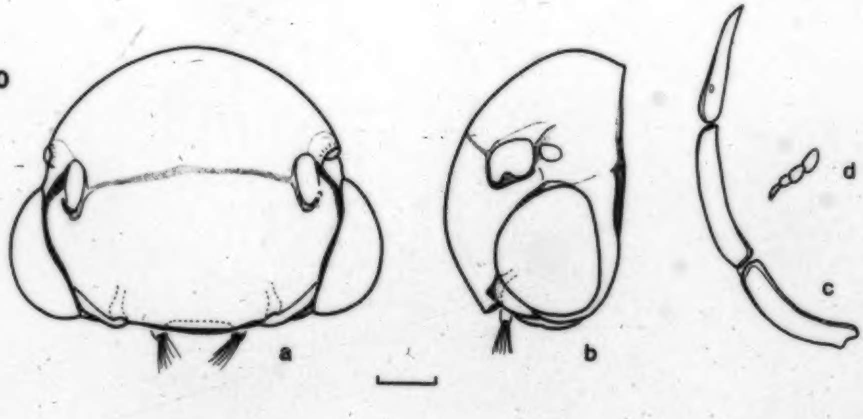


Figures 101 to 103. Comparison of denuded heads (mouthparts and antennae omitted) and of palpi scythridids; (a) head, frontal aspect; (b) head, lateral aspect; (c) labial palp, lateral aspect; (d) maxillary palp, frontal aspect.

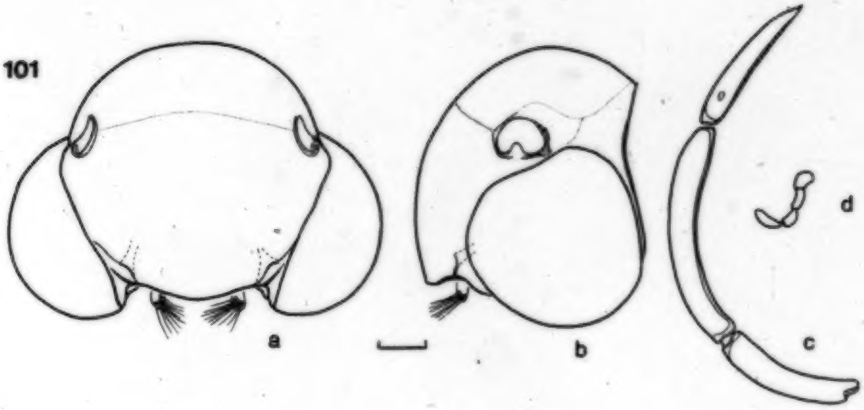
Scale bars = 0.1 mm.

Figure 101. *Neoscythris fissirostris* .

Figure 102. *Neoscythris* undescribed species 98.

Figure 103. *Areniscythris* undescribed species 195.

101



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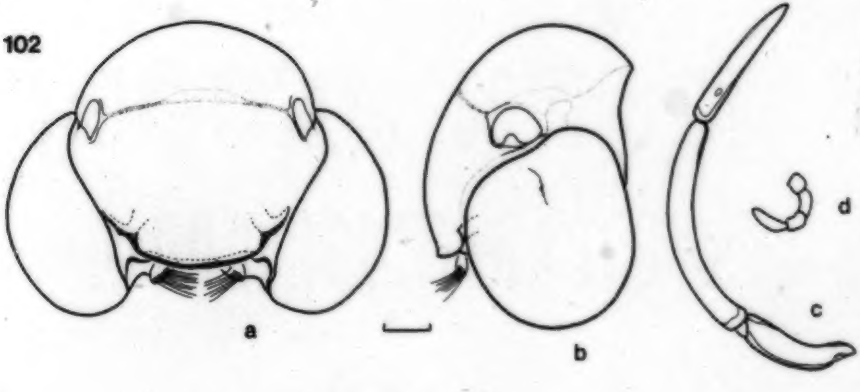

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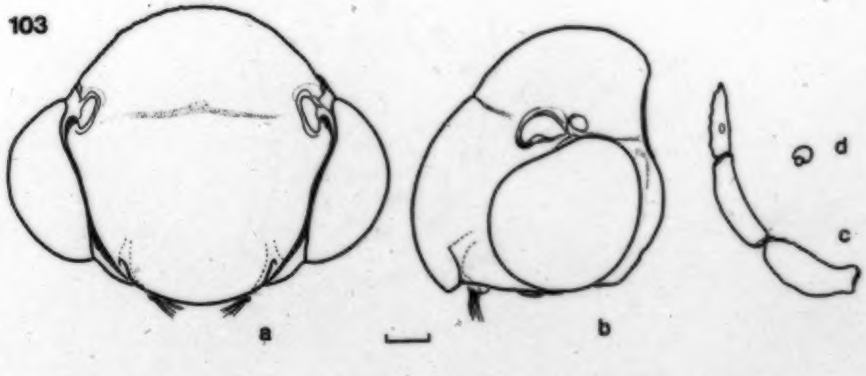


Figures 104 to 106. Comparison of denuded heads (mouthparts and antennae omitted) and of palpi scythridids; (a) head, frontal aspect; (b) head, lateral aspect; (c) labial palp, lateral aspect; (d) maxillary palp, frontal aspect.

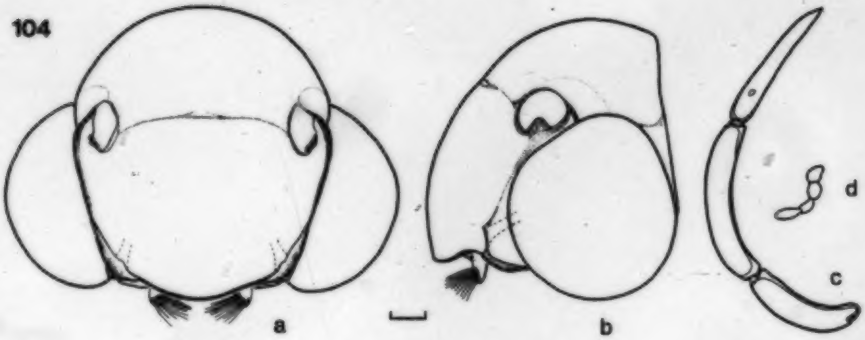
Scale bars = 0.1 mm.

Figure 104. *Colinita sponsella* .

Figure 105. *Arotrura eburnea* .

Figure 106. *Oncoxystus longissimus* .

104



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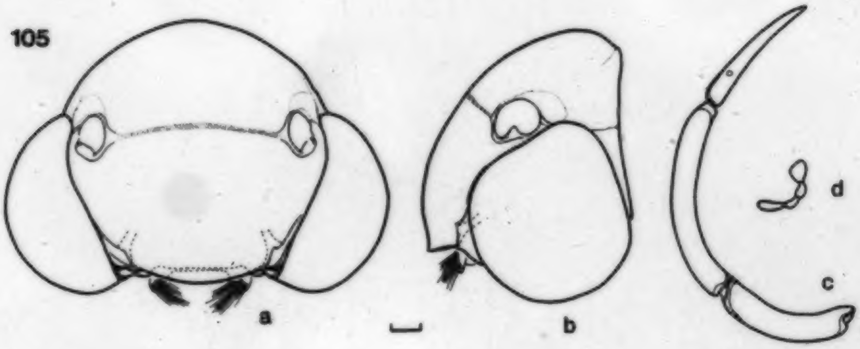

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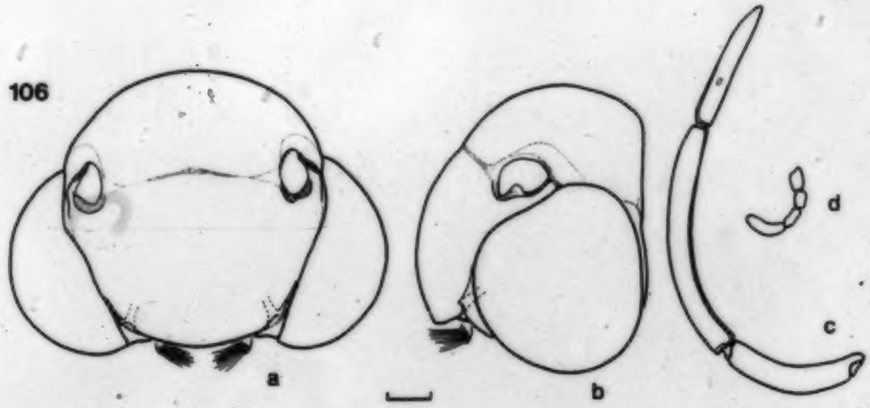


Figures 107 to 109. Comparison of denuded heads (mouthparts and antennae omitted) and of palpi scythridids; (a) head, frontal aspect; (b) head, lateral aspect; (c) labial palp, lateral aspect; (d) maxillary palp, frontal aspect.

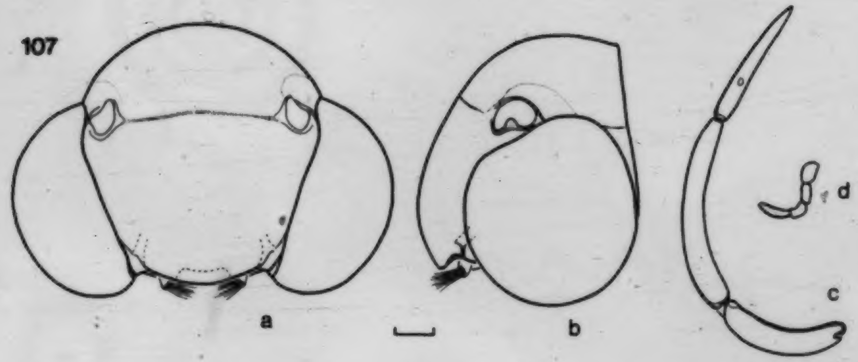
Scale bars = 0.1 mm.

Figure 107. *Meniscotus* undescribed species 145.

Figure 108. *Mimiella divaricata* .

Figure 109. *Serangites* undescribed species 89.

107



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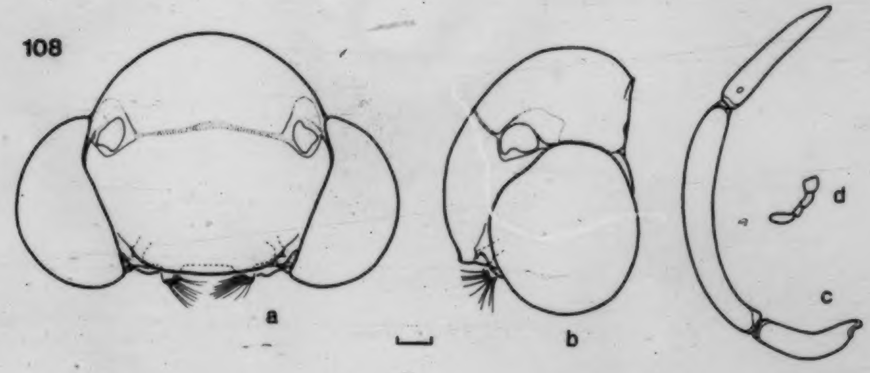

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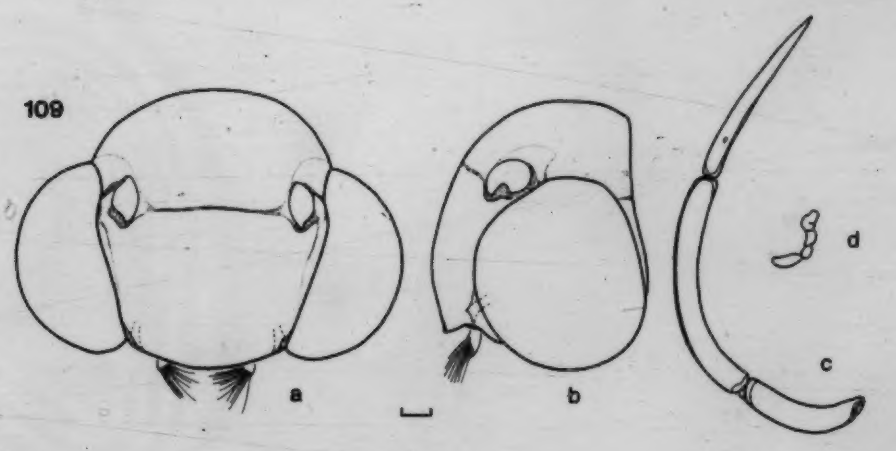
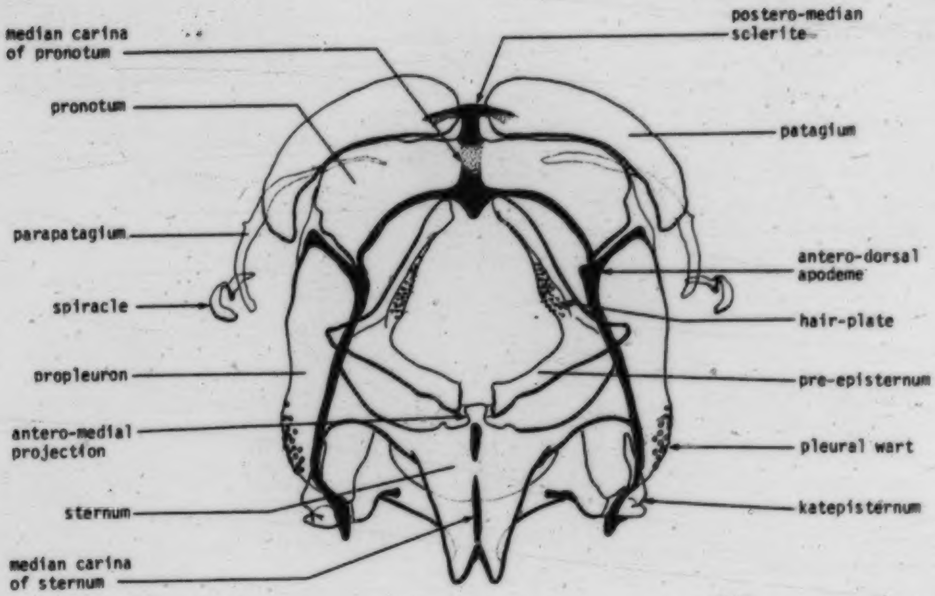


Figures 110 to 112. Structure of prothorax of *Scythris limbella* . Scale bars = 0.1 mm.

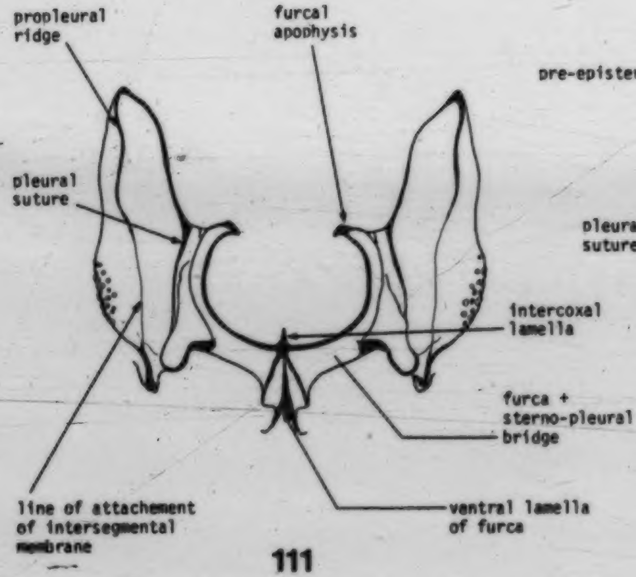
Figure 110. Frontal aspect.

Figure 111. Posterior aspect.

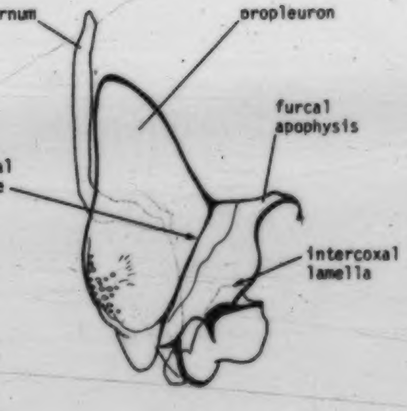
Figure 112. Lateral aspect.


median carina of pronotum
postero-median sclerite
pronotum
patagium
parapatagium
antero-dorsal apodeme
spiracle
hair-plate
propleuron
pre-episternum
antero-medial projection
pleural wart
sternum
katepisternum
median carina of sternum

110

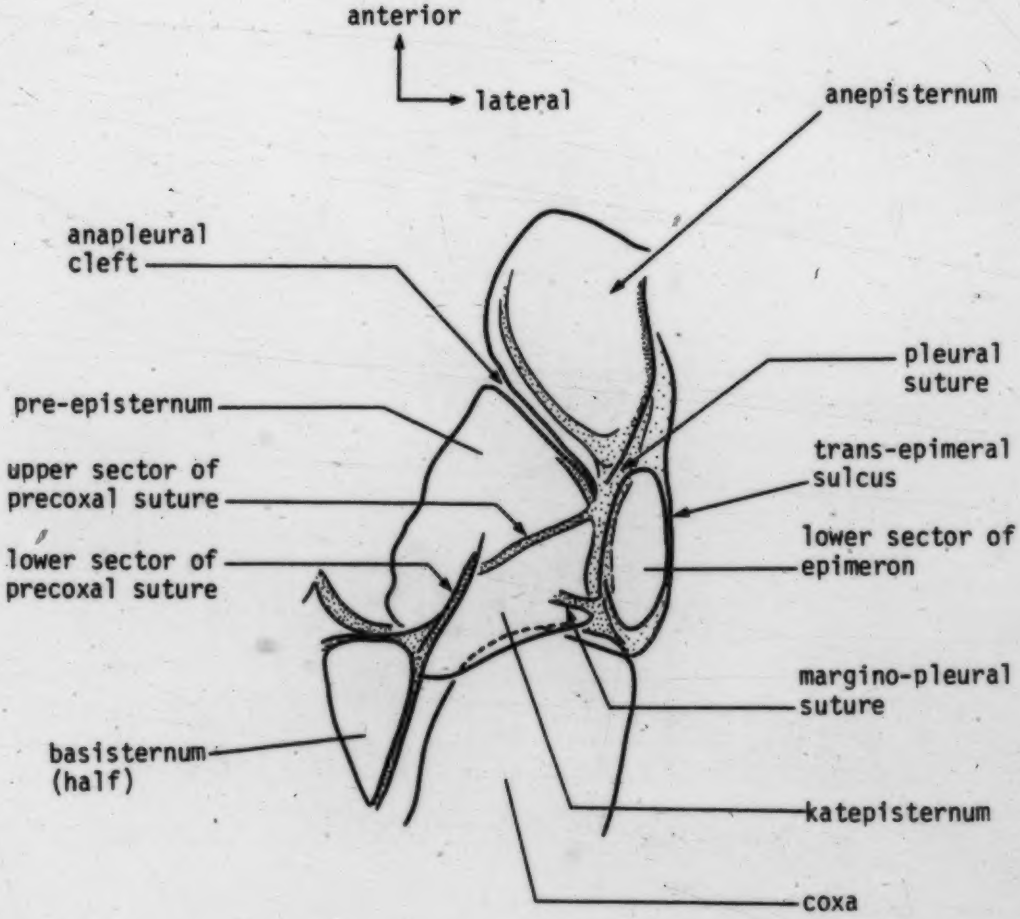

propleural ridge
furcal apophysis
pleural suture
intercoxal lamella
furca + sterno-pleural bridge
line of attachement of intersegmental membrane
ventral lamella of furca

111


pre-episternum
propleuron
furcal apophysis
pleural suture
intercoxal lamella

112

Figure 113. Latero-ventral aspect of sterno-pleural region of mesothorax of imaginary scythridid (denuded of scales), showing structures.


anterior
lateral
anepisternum
anapleural cleft
pleural suture
pre-episternum
trans-epimeral sulcus
upper sector of precoxal suture
lower sector of epimeron
lower sector of precoxal suture
margino-pleural suture
basisternum (half)
katepisternum
coxa

113

Figures 114 to 117. Comparison of structure of sterno-pleural region of mesothorax of scythridids, in latero-ventral aspect. Scale bars = 0.1 mm.

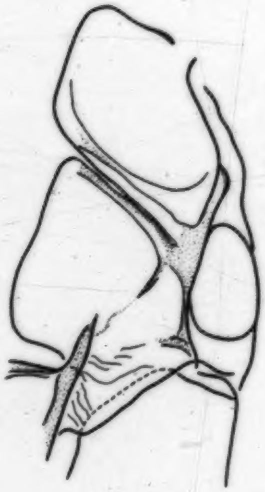
Figure 114. *Scythris limbella* .

Figure 115. *Scythris mixaula* .

Figure 116. *Rhamphura* undescribed species 224.

Figure 117. *Areniscythris* undescribed species 195.

114



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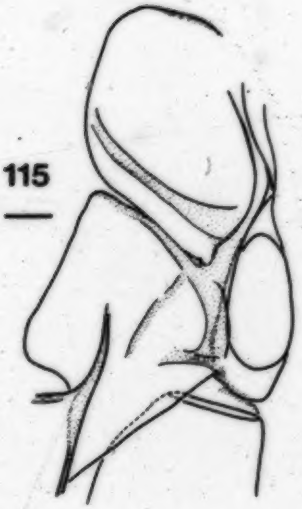

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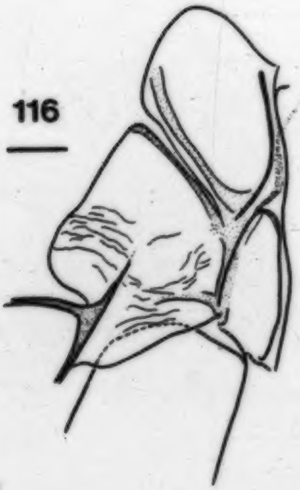

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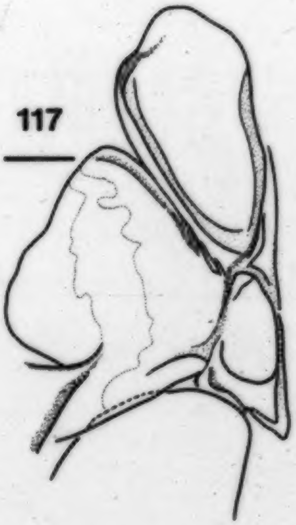


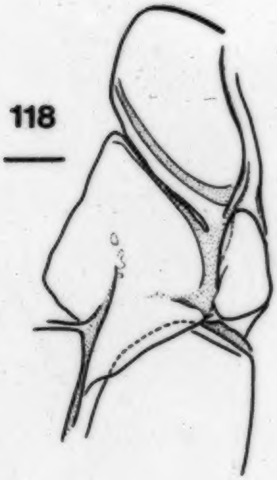
Figures 118 to 120. Comparison of structure of sterno-pleural region of mesothorax of scythridids, in latero-ventral aspect. Scale bars = 0.1 mm.

Figure 118. *Neoscythris fissirostris* .

Figure 119. *Neoscythris* undescribed species 166.

Figure 120. *Asymmetrura impositella* .

118



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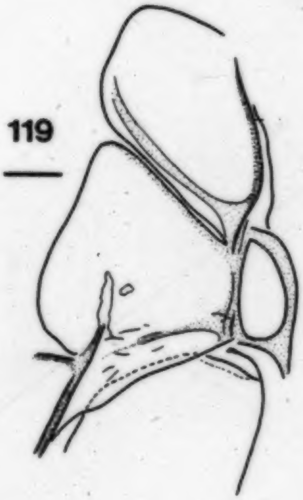

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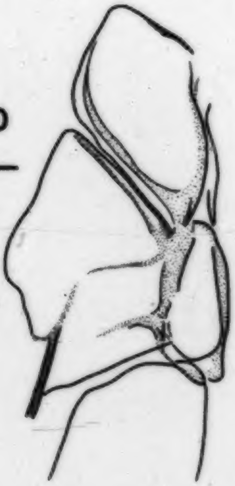


Figures 121 to 124. Comparison of structure of sterno-pleural region of mesothorax of scythridids, in latero-ventral aspect. Scale bars = 0.1 mm.

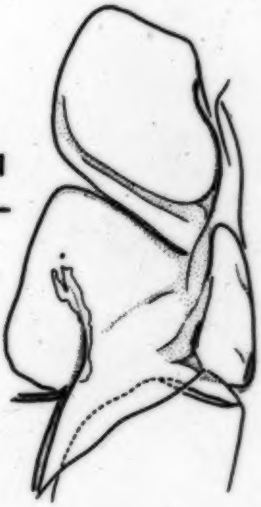
Figure 121. *Colinita sponsella* .

Figure 122. *Meniscotus* undescribed species 145 .

Figure 123. *Oncoxystus longissimus* .

Figure 124. *Arotrura eburnea* .

121



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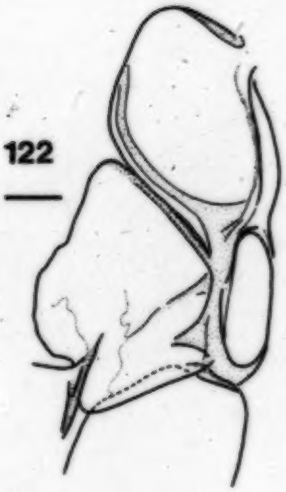

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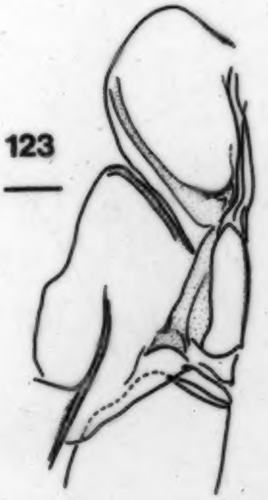

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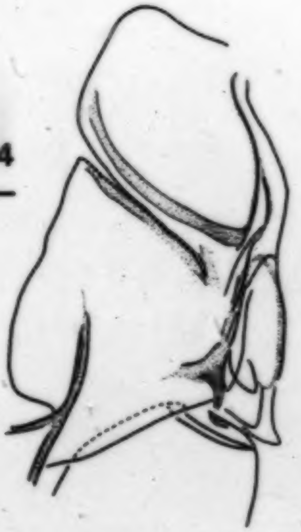


Figures 125 to 128. Comparison of structure of sterno-pleural region of mesothorax of scythridids, in latero-ventral aspect. Scale bars = 0.1 mm.

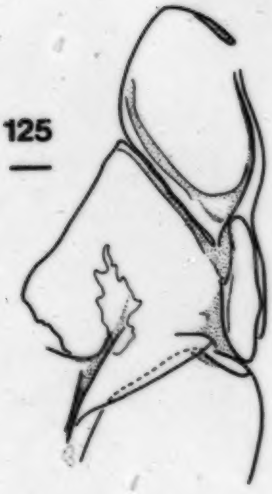
Figure 125. *Mimiella divaricata* .

Figure 126. *Mimiella* undescribed species 53 .

Figure 127. *Commodes* undescribed species 93.

Figure 128. *Serangites* undescribed species 88.

125



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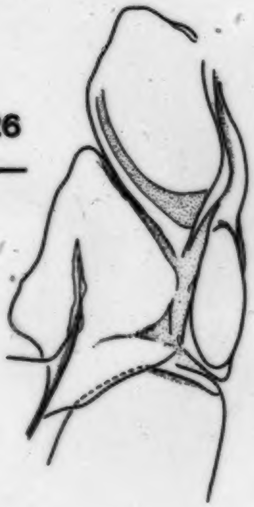

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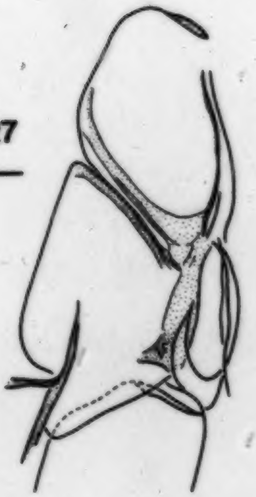

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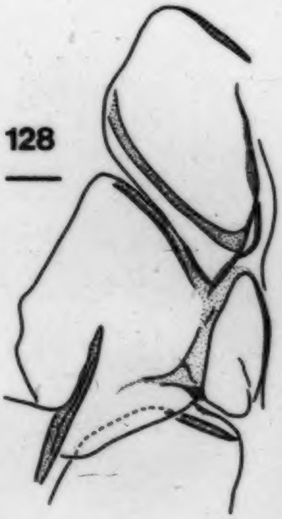
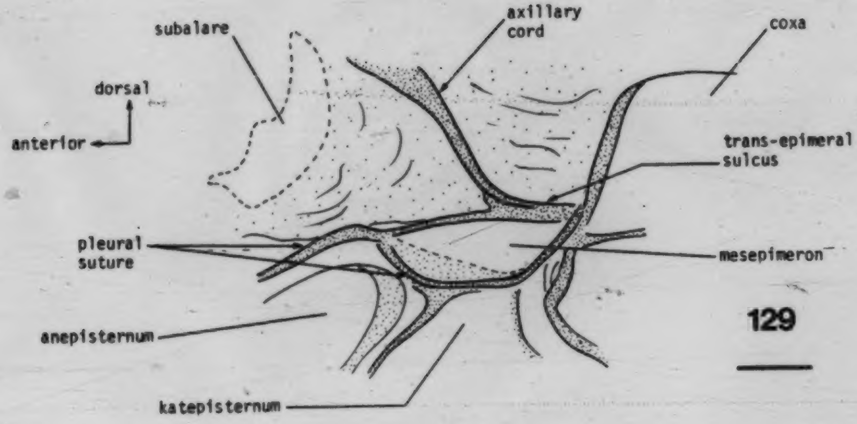


Figures 129 to 131. Lateral aspect of pleural region of mesothorax of scythridids, for comparison of structure. Scale bars = 0.1 mm.

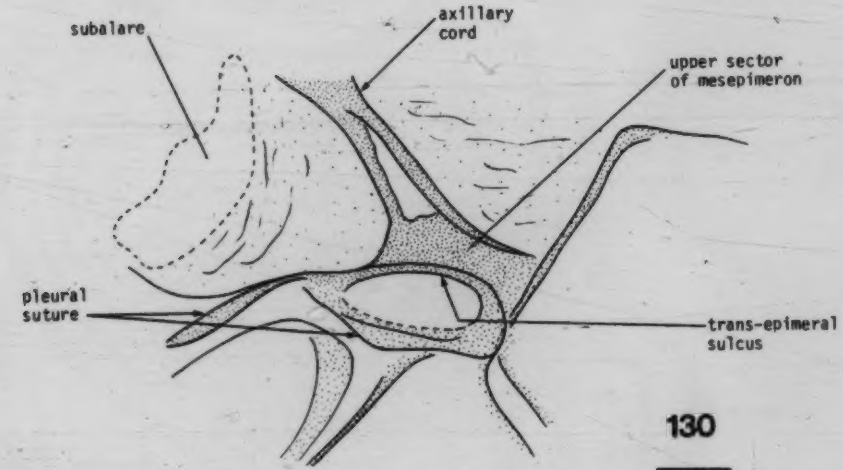
Figure 129. *Rhamphura* undescribed species 224.

Figure 130. *Neoscythris* undescribed species 166.

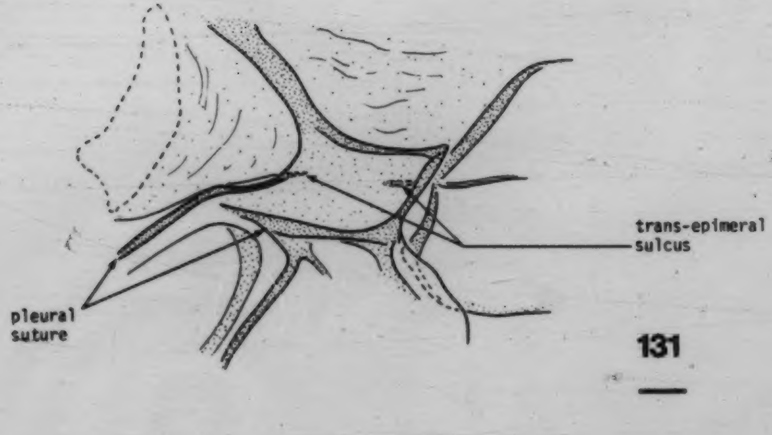
Figure 131. *Colinita sponsella* .


subalare
axillary cord
coxa
dorsal
anterior
trans-epimeral sulcus
pleural suture
mesepimeron
anepisternum
katepisternum

129


subalare
axillary cord
upper sector of mesepimeron
pleural suture
trans-epimeral sulcus

130


trans-epimeral sulcus
pleural suture

131

Figures 132 to 133. Ventral region of metathorax of scythridids, for comparison of structure. Scale bars = 0.2 mm.

Figure 132. *Colinita sponsella* .

Figure 133. *Rhamphura* undescribed species 224.

Figures 134 to 135. Posterior region of dorsum of metathorax of gelechioids (somewhat tilted to the left), for comparison of structure. Scale bars = 0.2 mm.

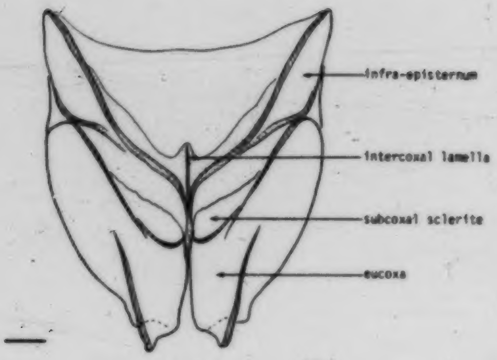
Figure 134. *Mimiella divaricata* , Scythrididae, illustrating abbreviated coxal suture.

Figure 135. *Lita sexpunctella* , Gelechiidae, illustrating complete coxal suture.

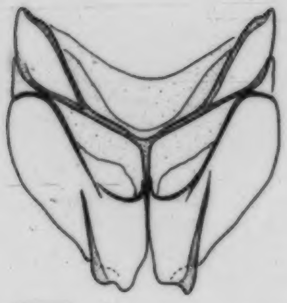
Figures 136 to 137. Comparison of posterior aspect of metathoracic furca of Microlepidoptera. Scale bars = 0.1 mm.

Figure 136. *Colinita sponsella* , Scythrididae, illustrating "joint" between stem and secondary arms.

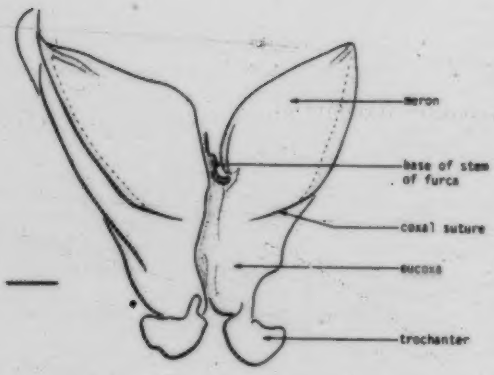
Figure 137. *Monopis* sp., Tineidae, illustrating stem continuous with secondary arms.


infra-episternum
intercoxal lamella
subcoxal sclerite
eucoxa

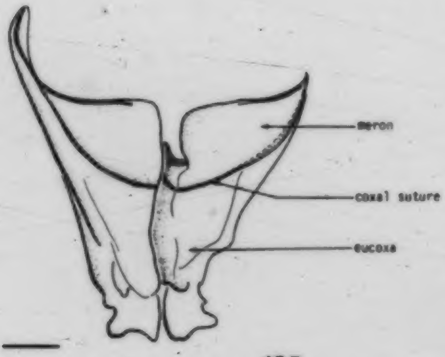
132



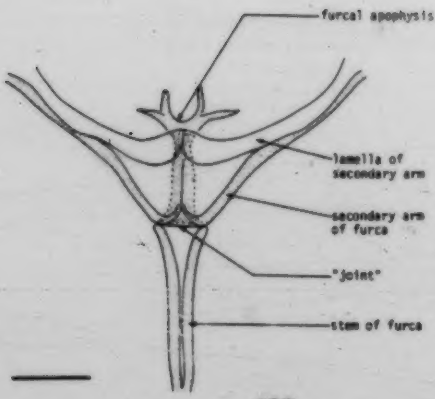
133


meron
base of stem of furca
coxal suture
eucoxa
trochanter

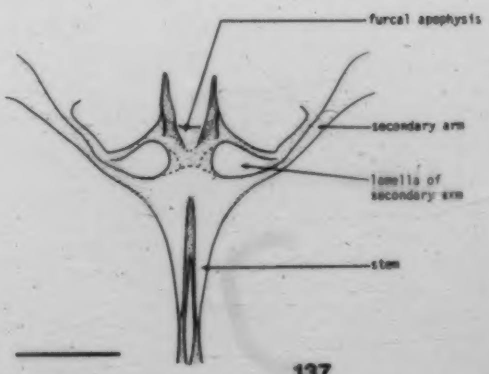
134


meron
coxal suture
eucoxa

135


furcal apophysis
lamella of secondary arm
secondary arm of furca
"joint"
stem of furca

136


furcal apophysis
secondary arm
lamella of secondary arm
stem

137

Figures 138 to 143. Comparison of structure of metathoracic furca of scythridids.

Scale bars = 0.1 mm.

Figure 138. *Scythris limbella* , lateral aspect.

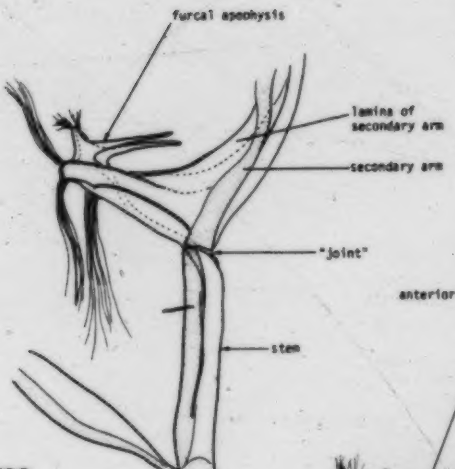
Figure 139. *Areniscythris* undescribed species 195, lateral aspect.

Figure 140. *Mimiella divaricata* , lateral aspect.

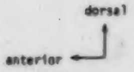
Figure 141. *Scythris limbella* , dorsal aspect.

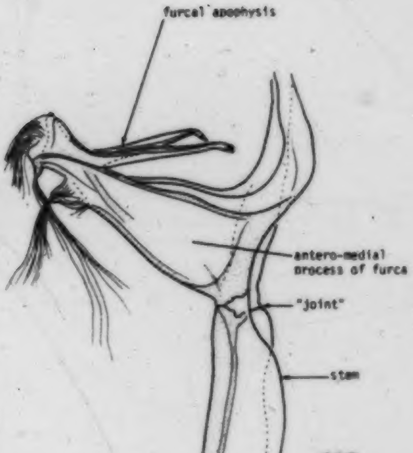
Figure 142. *Areniscythris* undescribed species 195, dorsal aspect.

Figure 143. *Mimiella divaricata* , dorsal aspect.

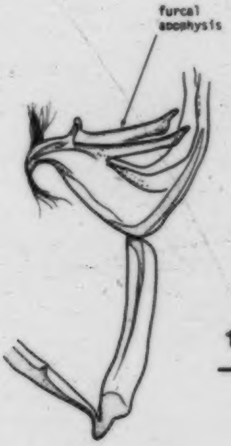

furcal apophysis
lamina of secondary arm
secondary arm
"joint"
stem

138

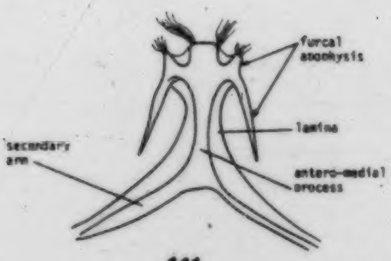

dorsal
anterior


furcal apophysis
antero-medial process of furca
"joint"
stem

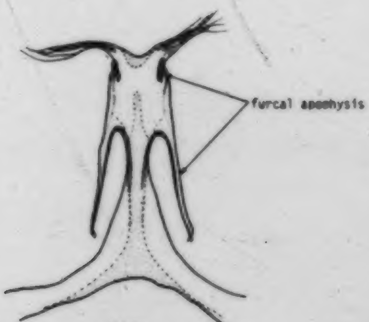
140


furcal apophysis

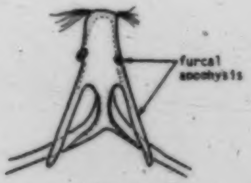
139


furcal apophysis
lamina
secondary arm
antero-medial process

141


furcal apophysis

143


furcal apophysis

142

Figures 144 to 149. Comparison of structure of metathoracic furca of Microlepidoptera.

Scale bars = 0.1 mm.

Figure 144. ***Agonopterix fulvipennella*****, Oecophoridae (Gelechioidea), lateral aspect.**

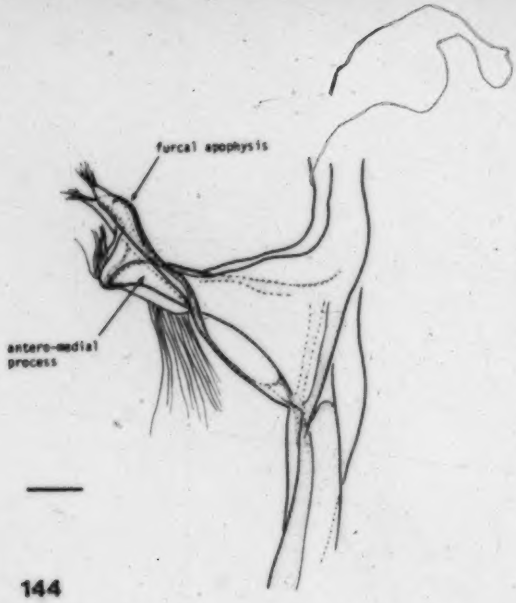
Figure 145. ***Agonopterix fulvipennella*****, Oecophoridae (Gelechioidea), dorsal aspect.**

Figure 146. ***Monopis*** **sp., Tineidae (Tineoidea), dorsal aspect.**

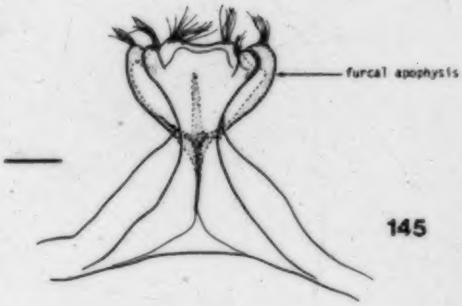
Figure 147. ***Monopis*** **sp., Tineidae (Tineoidea), lateral aspect.**

Figure 148. ***Ypsolopha dentiferella*****, Plutellidae (Yponomeutoidea), lateral aspect.**

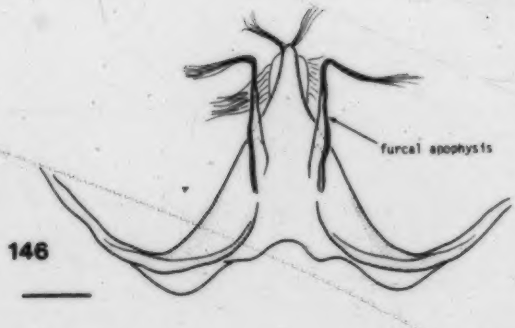
Figure 149. ***Ypsolopha dentiferella*****, Plutellidae (Yponomeutoidea), dorsal aspect.**


furcal apophysis
antero-medial process

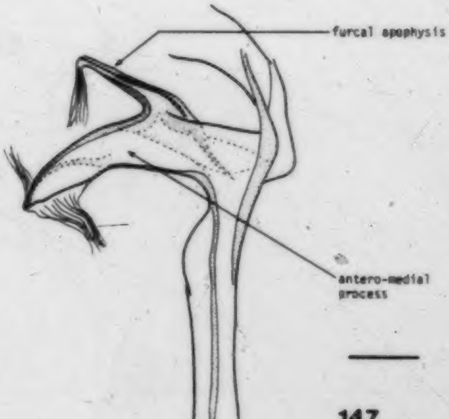
144


furcal apophysis

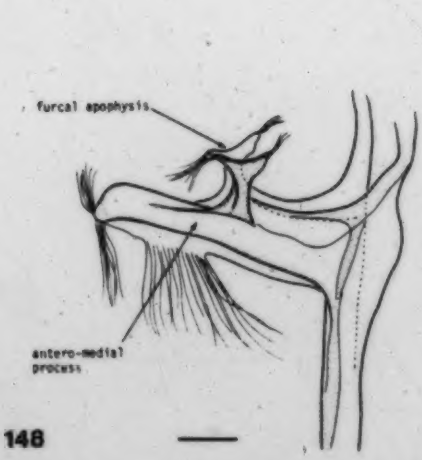
145


furcal apophysis

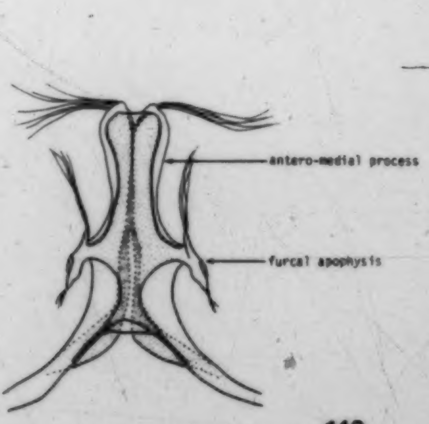
146


furcal apophysis
antero-medial process

147


furcal apophysis
antero-medial process

148


antero-medial process
furcal apophysis

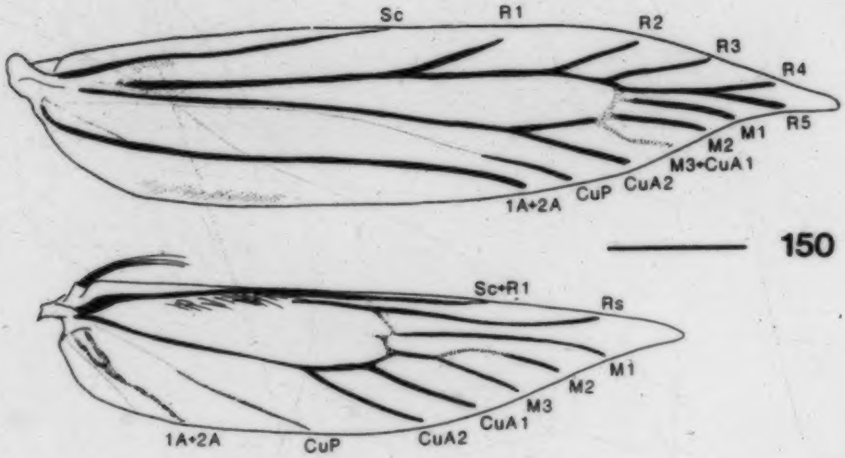
149

Figures 150 to 152. Comparison of structure of wings of scythridids. Scale bars = 1.0 mm.

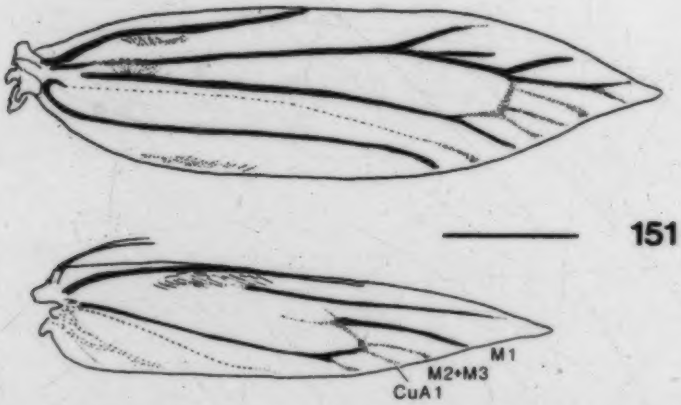
Figure 150. *Scythris limbella* .

Figure 151. *Scythris immaculatella* .

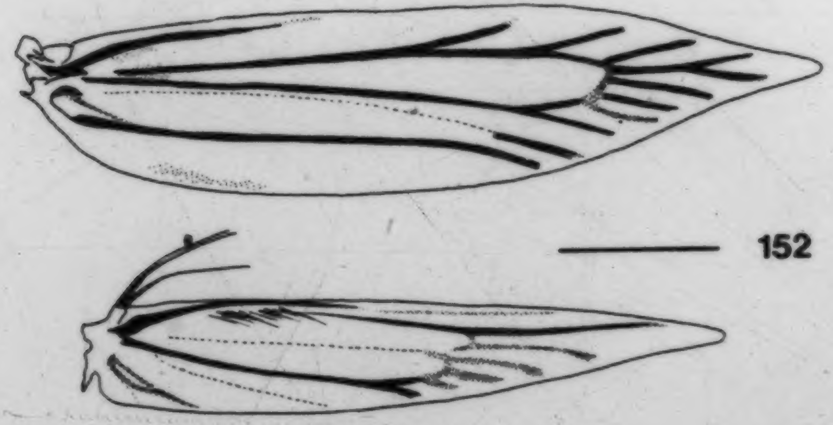
Figure 152. *Scythris trivinctella* .


Sc
R1
R2
R3
R4
R5
M1
M2
M3+CuA1
CuA2
CuP
1A+2A
Sc+R1
Rs
M1
M2
M3
CuA1
CuA2
CuP
1A+2A

150


M1
M2+M3
CuA1

151



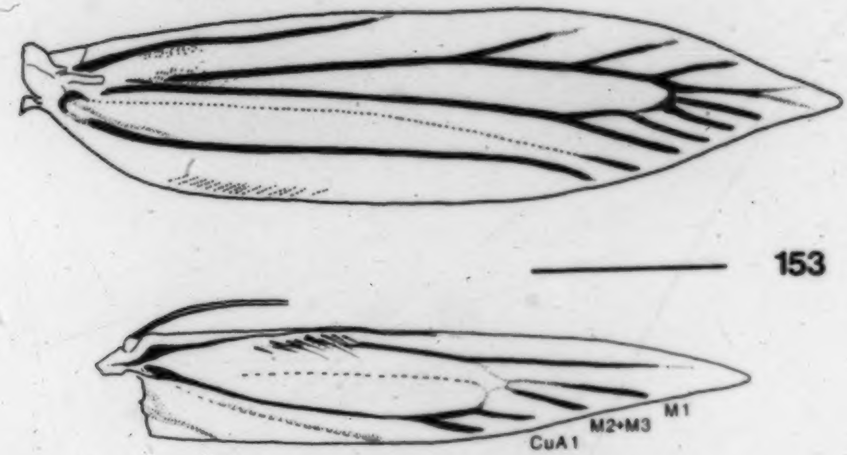
152

Figures 153 to 155. Comparison of structure of wings of scythridids. Scale bars = 1.0 mm.

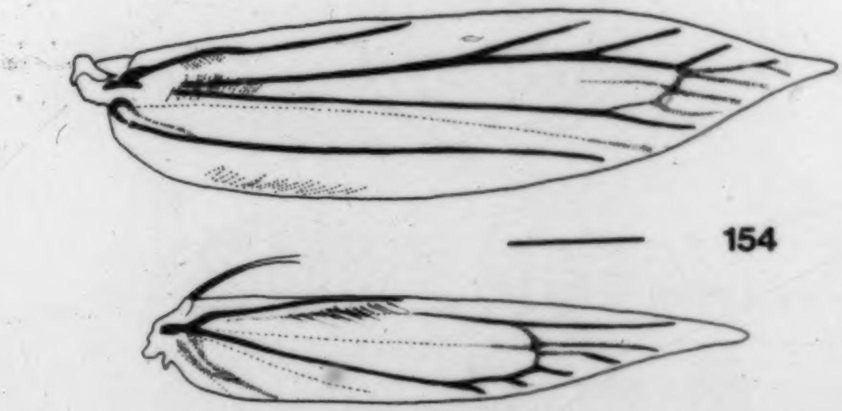
Figure 153. *Scythris interrupta* .

Figure 154. *Scythris basilaris* .

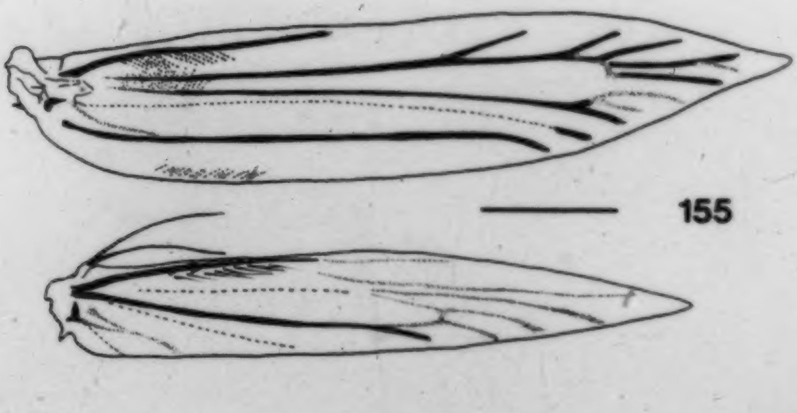
Figure 155. *Areniscythris* undescribed species 195.


M1
M2+M3
CuA1

153



154



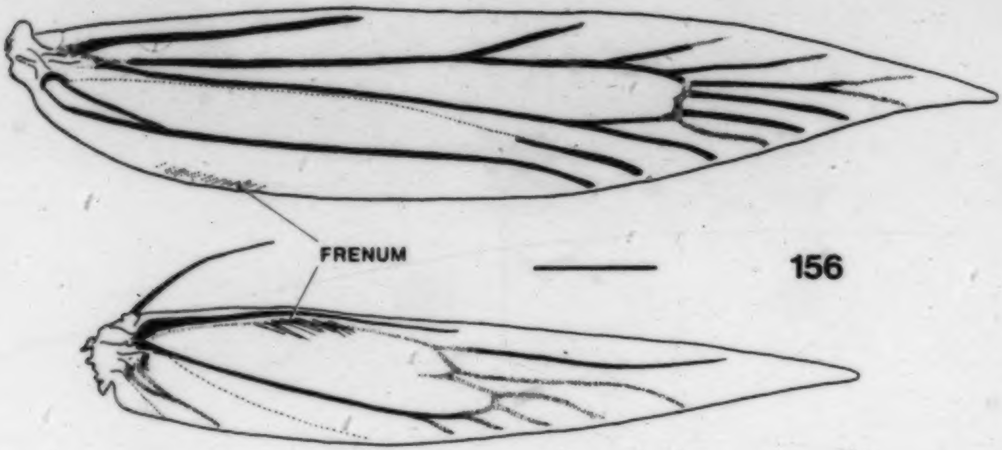
155

Figures 156 to 158. Comparison of structure of wings of scythridids. Scale bars = 1.0 mm.

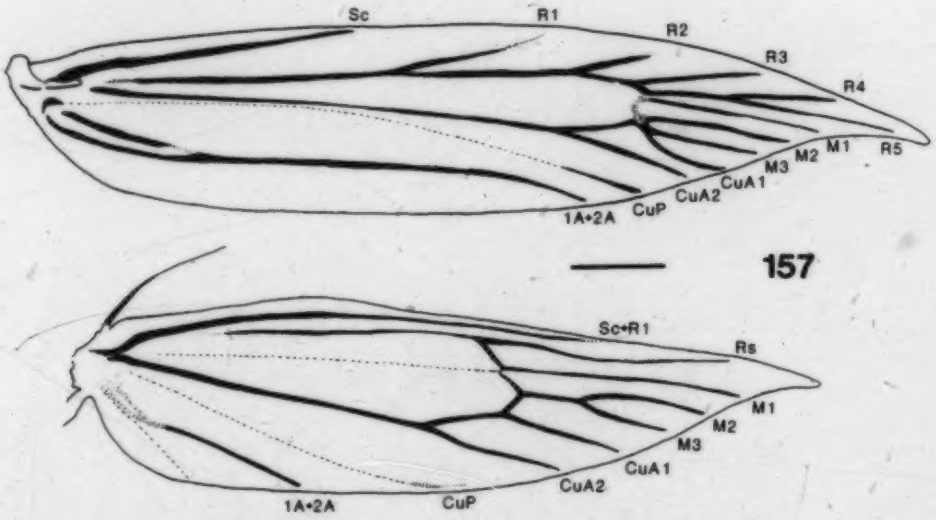
Figure 156. *Scythris mixaula* .

Figure 157. *Arotrura eburnea* .

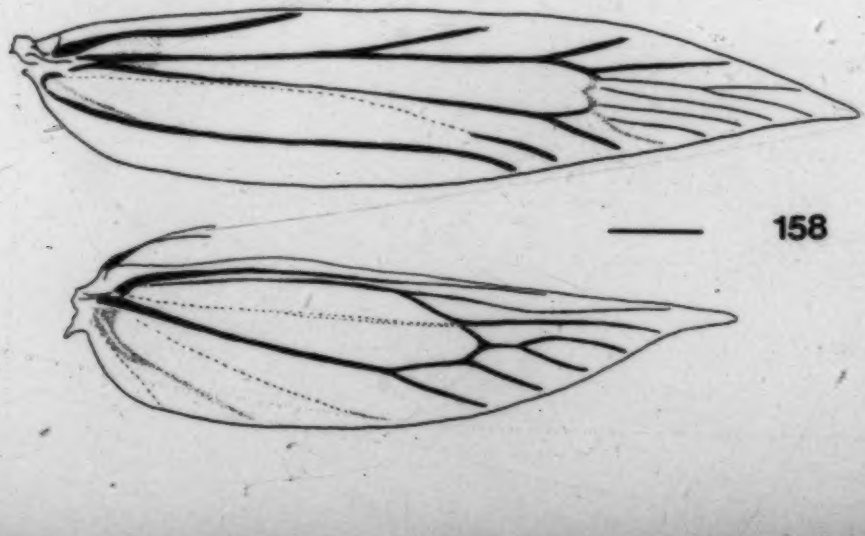
Figure 158. *Mimiella divaricata* .


FRENUM

156


Sc
R1
R2
R3
R4
R5
M1
M2
M3
CuA1
CuA2
CuP
1A+2A
Sc+R1
Rs
M1
M2
M3
CuA1
CuA2
CuP
1A+2A

157



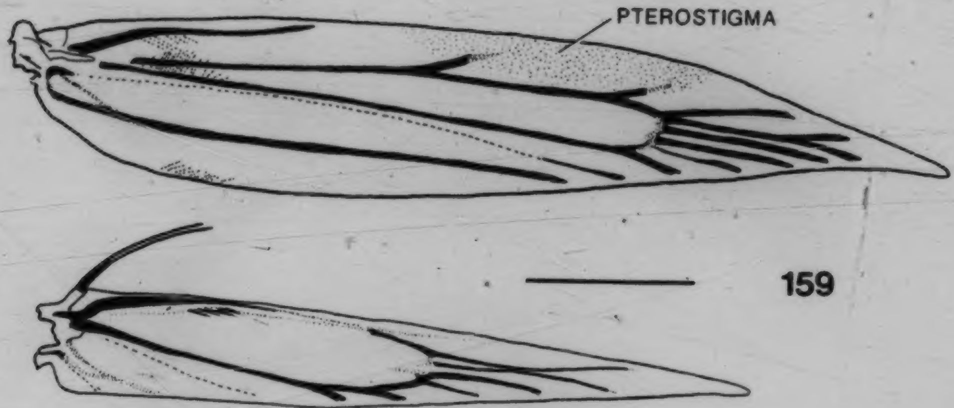
158

Figures 159 to 161. Comparison of structure of wings of scythridids. Scale bars = 1.0 mm.

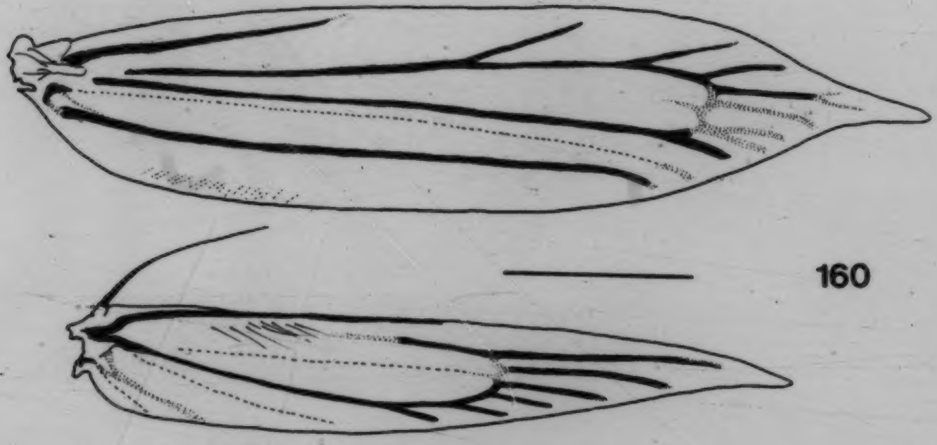
Figure 159. *Neoscythris fissirostris* .

Figure 160. *Asymmetrura scintillifera* .

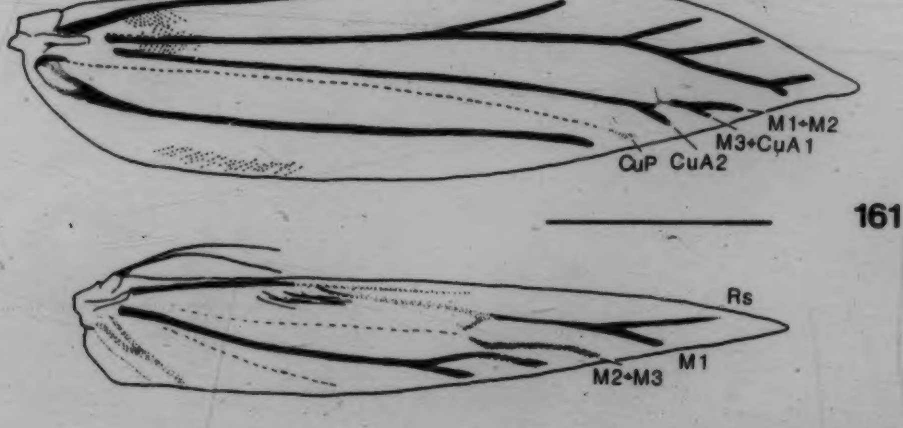
Figure 161. *Asymmetrura reducta* .


PTEROSTIGMA

159



160


M1+M2
M3+CuA1
CuP
CuA2
Rs
M1
M2+M3

161

Figures 162 to 166. Distal portion of wings of scythridids, illustrating venation.

Scale bars = 0.5 mm.

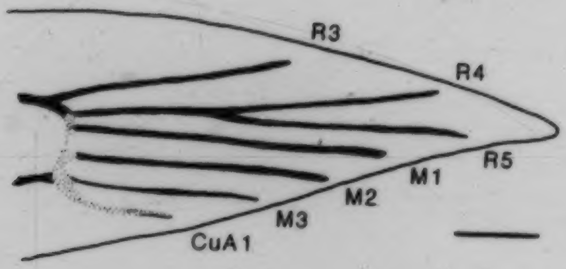
Figure 162. *Mimiella* undescribed species 68, forewing.

Figure 163. *Mimiella* undescribed species 53, hindwing.

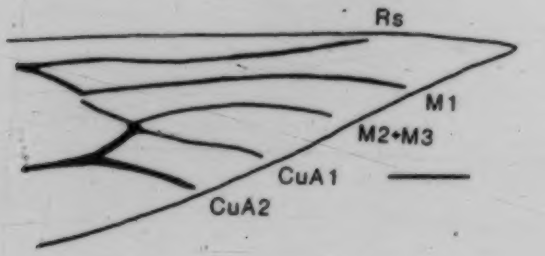
Figure 164. *Mimiella* undescribed species 207, forewing.

Figure 165. *Serangites* undescribed species 241, forewing.

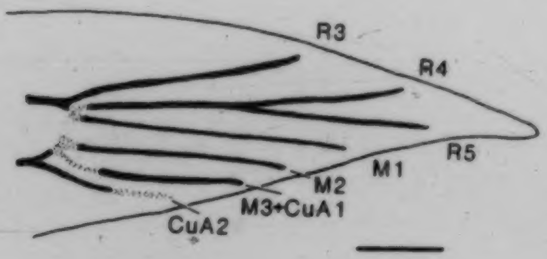
Figure 166. *Serangites* undescribed species 241, hindwing.


R3
R4
R5
M1
M2
M3
CuA1

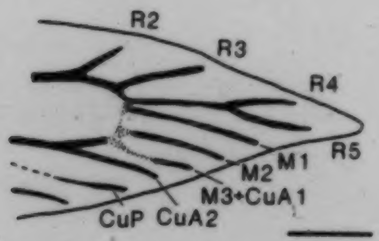
162


Rs
M1
M2+M3
CuA1
CuA2

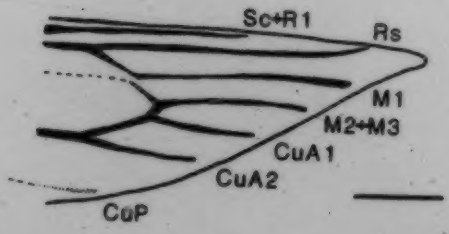
163


R3
R4
R5
M1
M2
M3+CuA1
CuA2

164


R2
R3
R4
R5
M1
M2
M3+CuA1
CuP
CuA2

165


Sc+R1
Rs
M1
M2+M3
CuA1
CuA2
CuP

166

Figures 167 to 169. Comparison of denuded terga 1 and 2 in dorsal aspect.

Scale bars = 0.1 mm.

Figure 167. *Meniscotus balli* , illustrating double transverse suture between T1 and T2.

Figure 168. *Scythris limbella* , illustrating complete posterior suture and interrupted anterior suture.

Figure 169. *Rhamphura ochristriata* , illustrating single transverse suture between T1 and T2.

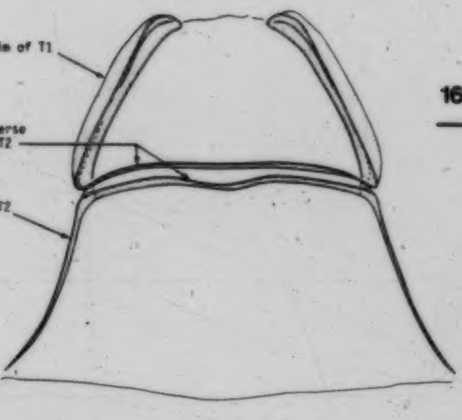
Figures 170 to 172. Comparison of denuded sterna 1+2 in ventral aspect.

Scale bars = 0.1 mm.

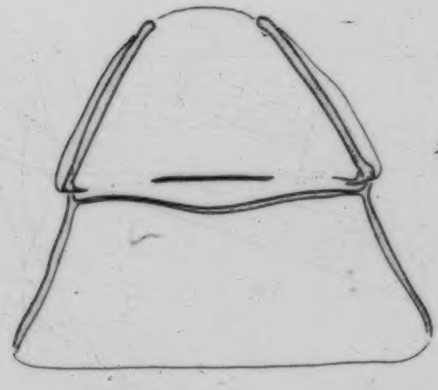
Figure 170. *Meniscotus balli* , illustrating fully developed apodemes and venulae.

Figure 171. *Colinita sponsella* , illustrating fully developed apodemes and obsolete venulae.

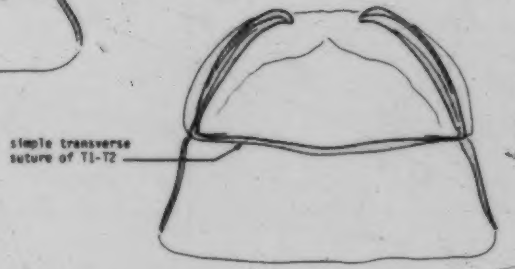
Figure 172. *Rhamphura ochristriata* , illustrating fully developed apodemes and absence of venulae.


lateral rim of T1
double transverse suture of T1-T2
lateral rim of T2

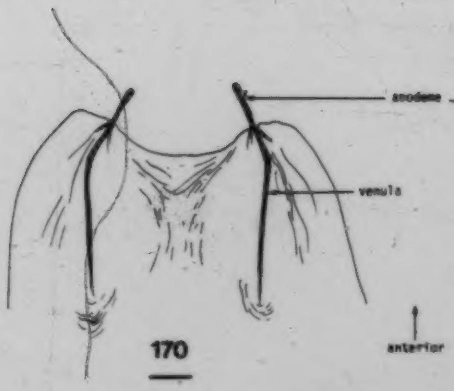
167



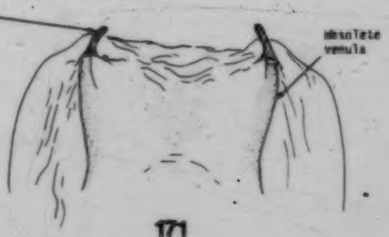
168


simple transverse suture of T1-T2

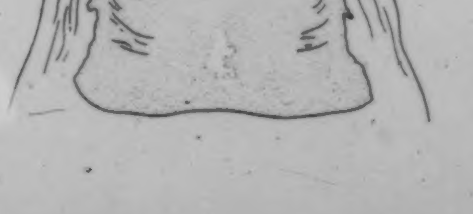
169


amodeme
venula
anterior

170


obsolete venula

171


amodeme
S1+S2

172

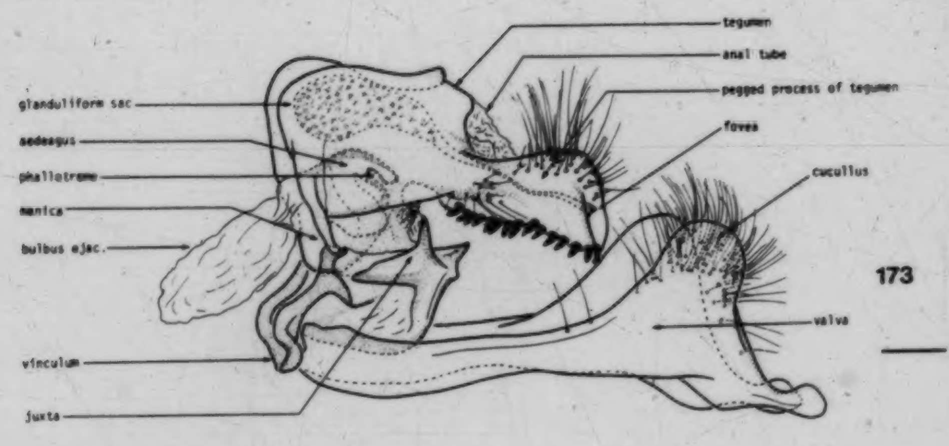
Figures 173 to 175. Structure of male genitalia and abdominal segment 8 of *Rhamphura ochristriata* . Scale bars = 0.1 mm.

Figure 173. Male genitalia, left lateral aspect; "bulbus ejac." = bulbus ejaculatorius.

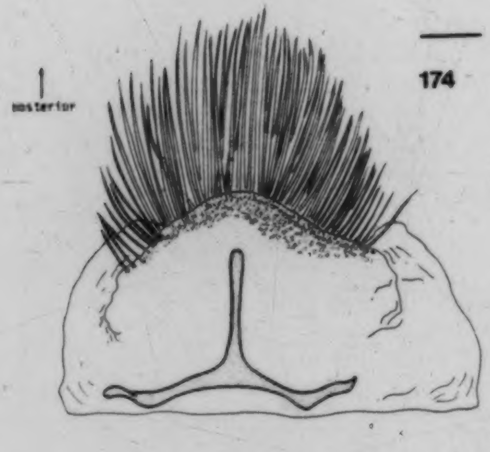
Figure 174. Tergum 8, dorsal aspect.

Figure 175. Sternum 8, ventral aspect.

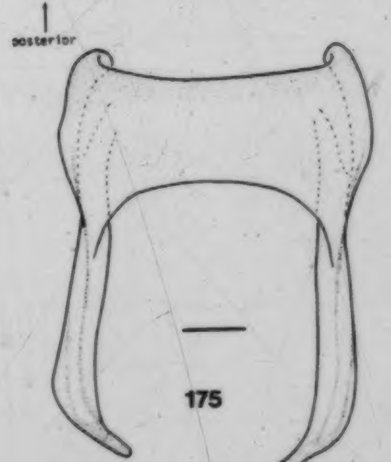
Figure 176. Male genitalia of *Rhamphura suffusa* , left lateral aspect. Scale bar = 0.1 mm.


tegumen
anal tube
pegged process of tegumen
glanduliform sac
aedeagus
phallotreme
manica
bulbus ejac.
fovea
cucullus
valva
vinculum
juxta

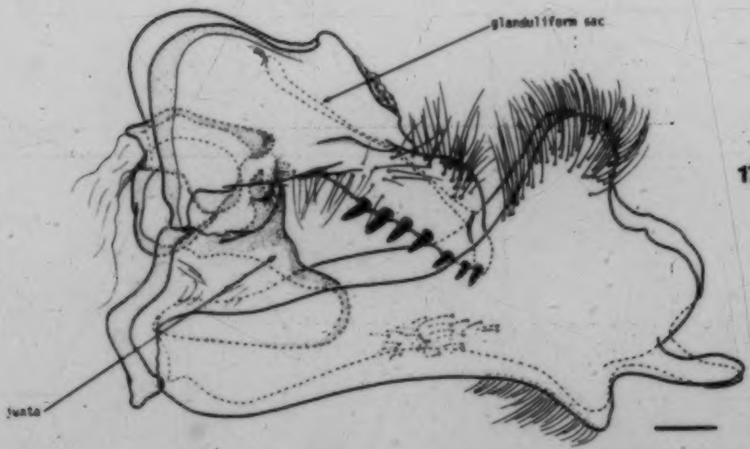
173



174



175


glanduliform sac
juxta

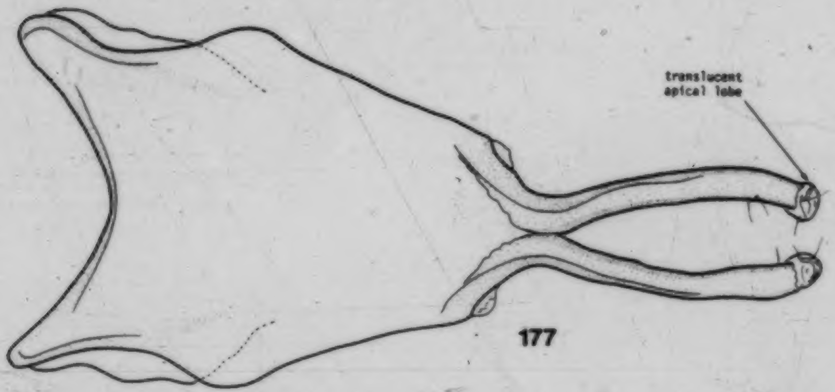
176

Figures 177 to 178. Male sternum 8 of *Scythris mixaula* . Scale bars = 0.1 mm.

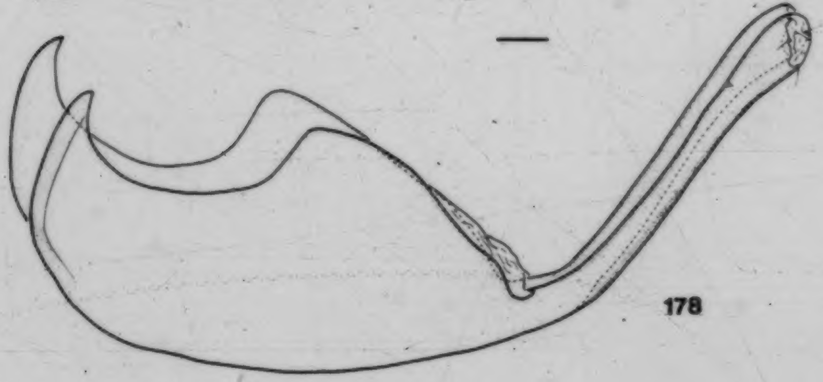
Figure 177. Ventral aspect.

Figure 178. Left lateral aspect.

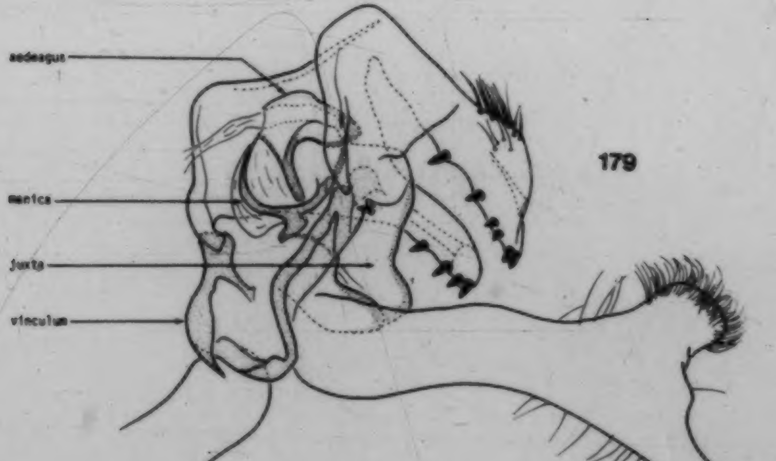
Figure 179. Male genitalia of *Rhamphura perspicillella* , antero-lateral aspect; part of tegumen, vinculum, and juxta deformed. Scale bar = 0.1 mm.


translucent apical lobe

177



178


aedeagus
manica
juxta
vinculum

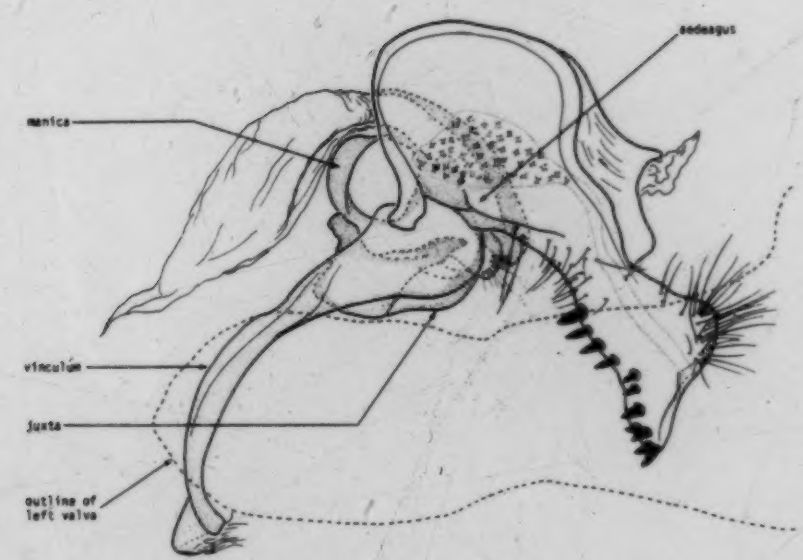
179

Figures 180 to 182. Male genitalia of *Rhamphura altisierrae* . Scale bars = 0.1 mm.

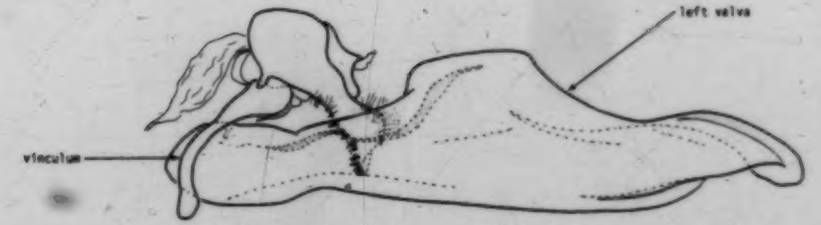
Figure 180. Left lateral aspect, basal part of left valva shown only in outline.

Figure 181. Left lateral aspect, smaller scale than Fig. 180, showing complete left valva.

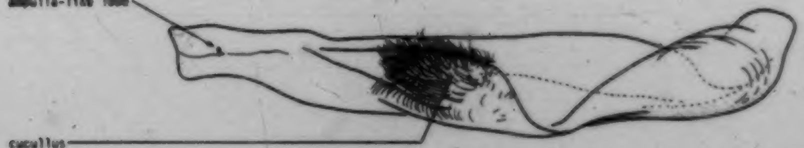
Figure 182. Left valva, dorsal aspect.


aedeagus
manica
vinculum
juxta
outline of left valva

180


left valva
vinculum

181


ampulla-like lobe
cucullus

182

Figures 183 to 186. Structure of male genitalia and abdominal segment 8 of *Scythris limbella*

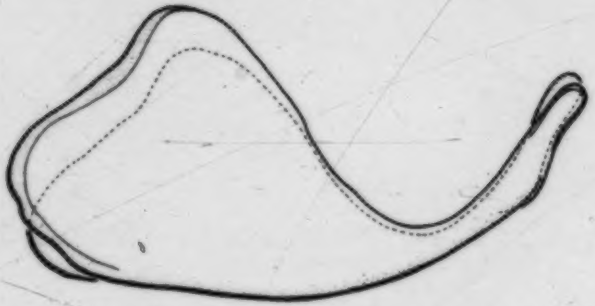
. Scale bars = 0.1 mm.

Figure 183. Sternum 8, left lateral aspect.

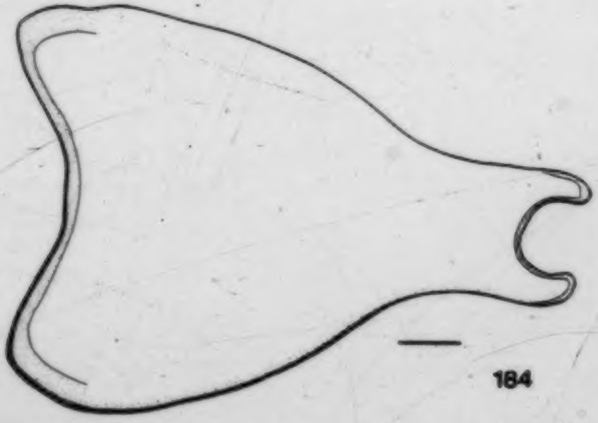
Figure 184. Sternum 8, ventral aspect.

Figure 185. Genitalia, left lateral aspect.

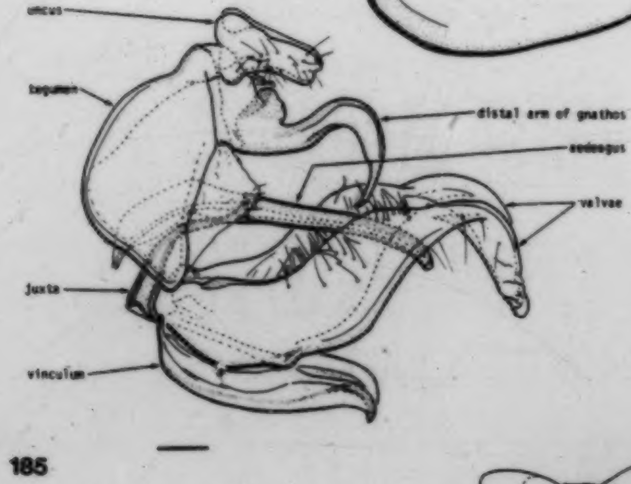
Figure 186. Genitalia, dorsal aspect.



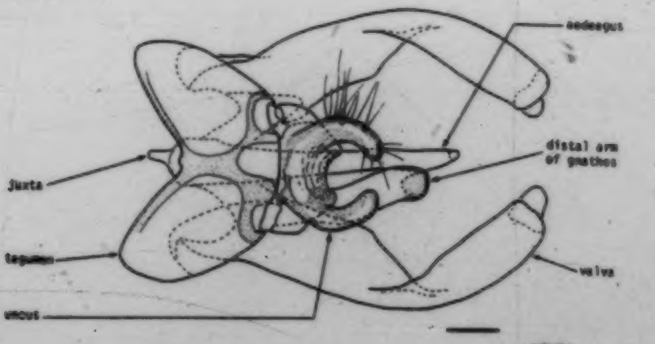
183



184


uncus
tegumen
distal arm of gnathos
aedeagus
valvae
juxta
vinculum

185


aedeagus
distal arm
of gnathos
juxta
tegumen
valva
uncus

186

Figures 187 to 190. Structure of male genitalia and tergum 8 of *Scythris mixaula* .

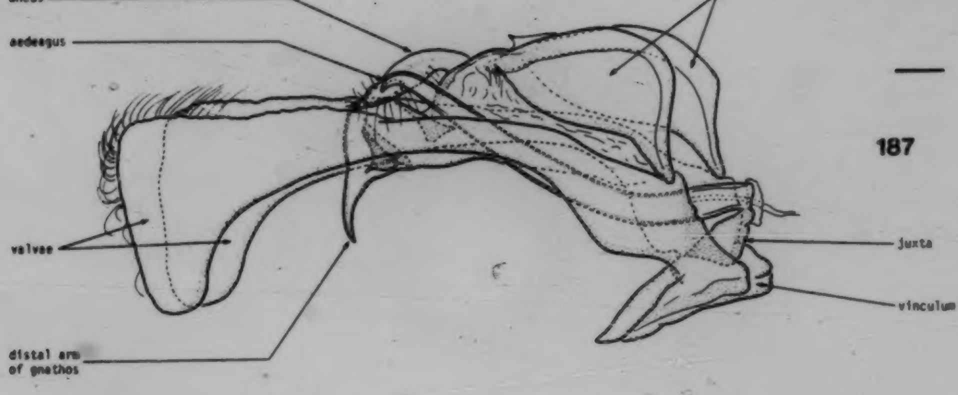
Scale bars = 0.1 mm.

Figure 187. Genitalia, right lateral aspect.

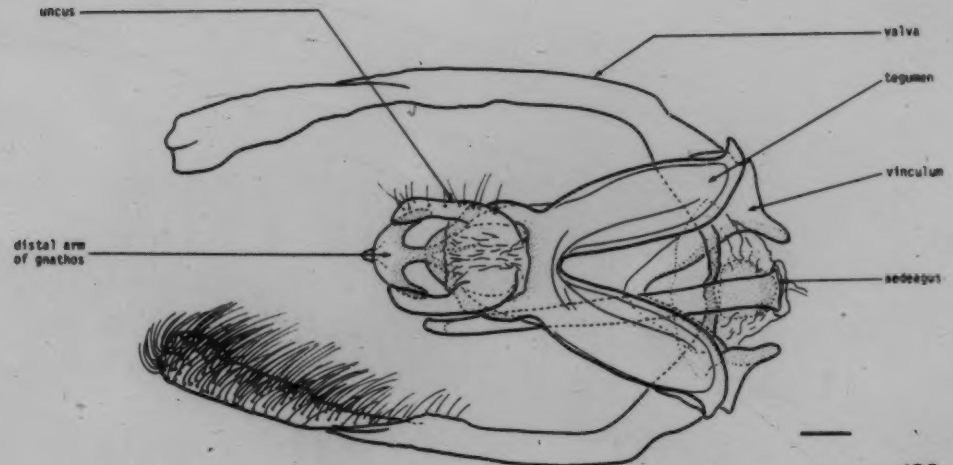
Figure 188. Genitalia, dorsal aspect.

Figure 189. Gnathos, caudal aspect.

Figure 190. Tergum 8, dorsal aspect.

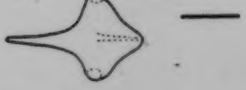

uncus
aedeagus
tegumen
valvae
juxta
vinculum
distal arm
of gnathos

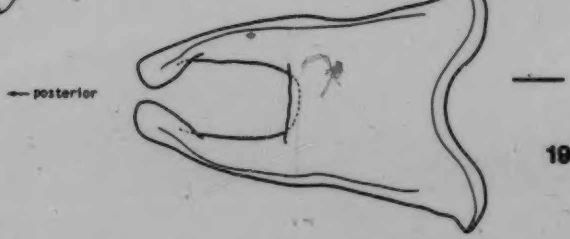
187


uncus
valva
tegumen
vinculum
distal arm
of gnathos
aedeagus

188

189





190

Figure 191. Male abdominal segment 8 of *Neoscythris planipenella* , dorsal aspect.

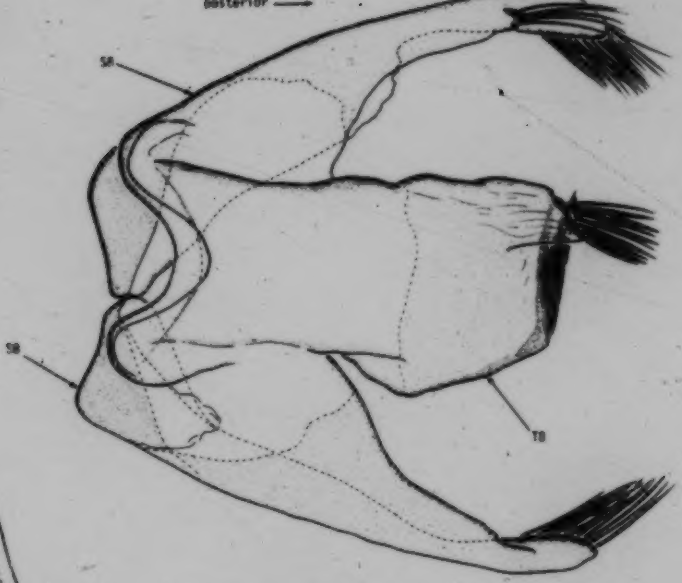
Scale bar = 0.1 mm.

Figures 192 to 193. Structure of male sternum 8 and genitalia of *Scythris immaculatella* .

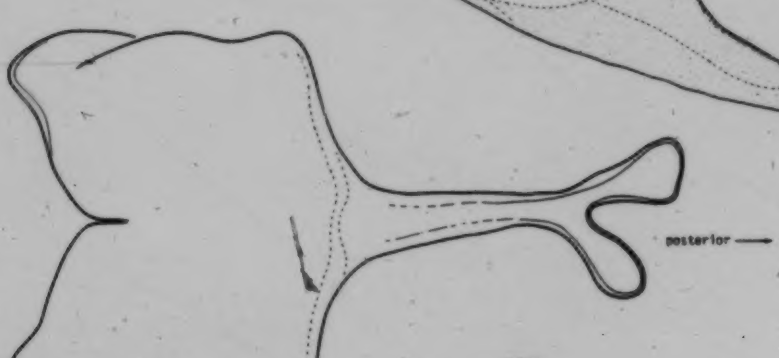
Scale bars = 0.1 mm.

Figure 192. Sternum 8, ventral aspect.

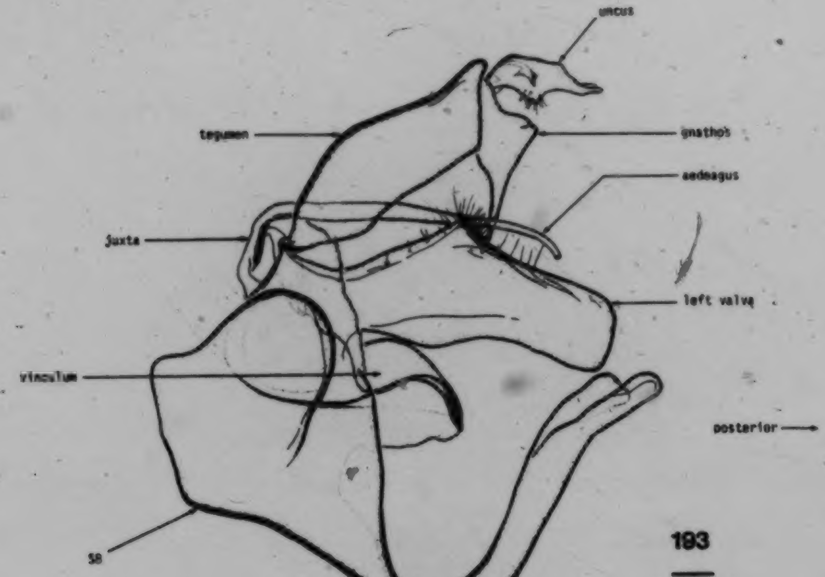
Figure 193. Sternum 8 and genitalia, left lateral aspect.


posterior →
S8
S8
T8

191


posterior →

192


uncus
tegumen
gnathos
aedeagus
juxta
left valve
vinculum
posterior →
S8

193

Figures 194 to 198. Structure of male genitalia and abdominal segment 8 of *Scythris trivinctella*. Scale bars = 0.1 mm.

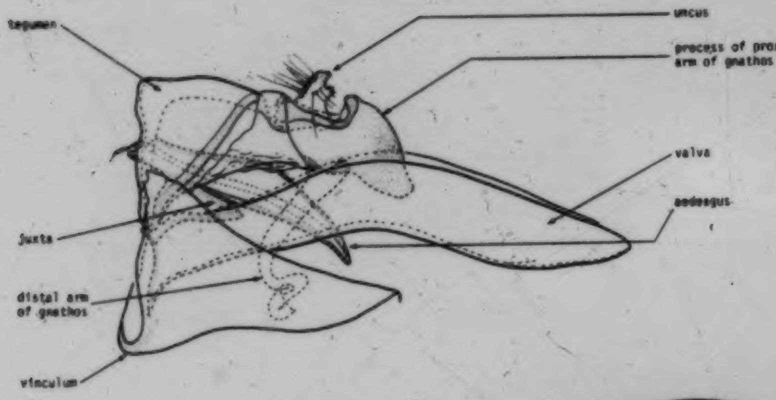
Figure 194. Genitalia, left lateral aspect.

Figure 195. Genitalia, dorsal aspect.

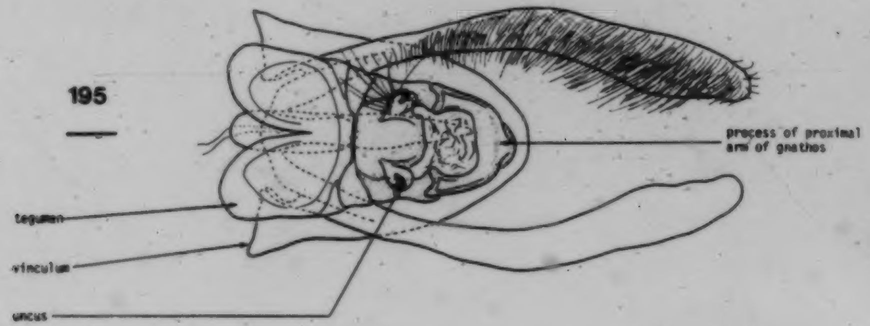
Figure 196. Distal arm of gnathos, caudal aspect.

Figure 197. Tergum 8, dorsal aspect.

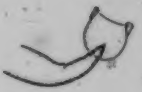
Figure 198. Stergum 8, ventral aspect.


tegumen
uncus
process of proximal arm of gnathos
valva
aedeagus
juxta
distal arm of gnathos
vinculum

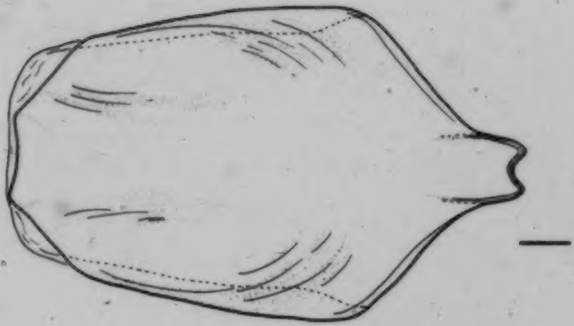
194


process of proximal arm of gnathos
tegumen
vinculum
uncus

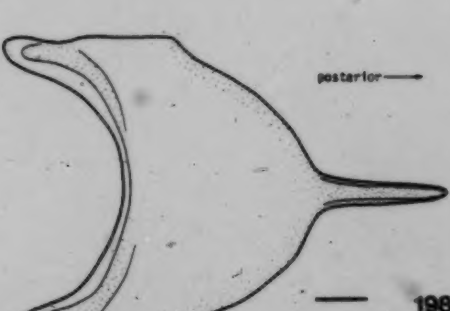
195



196



197



198

Figures 199 to 202. Structure of male genitalia and abdominal segment 8 of *Scythris ypsilon*

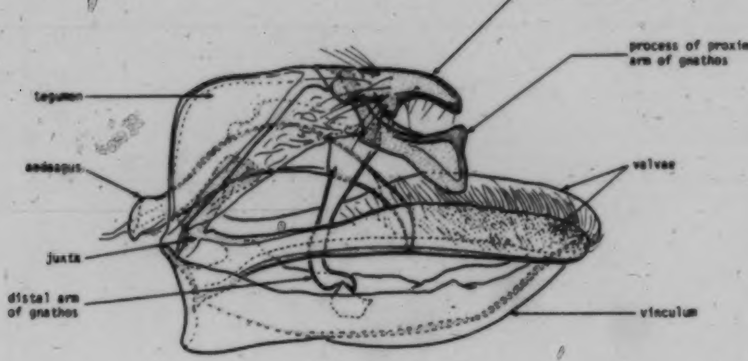
. Scale bars = 0.1 mm.

Figure 199. Genitalia, left lateral aspect.

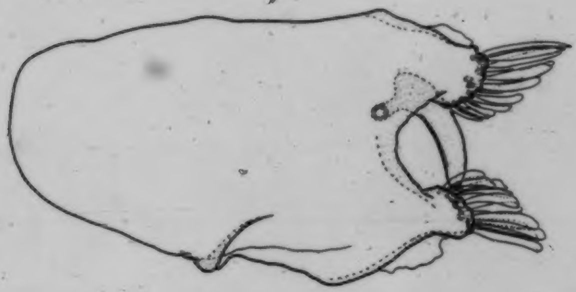
Figure 200. Tergum 8, dorsal aspect.

Figure 201. Sternum 8, ventral aspect.

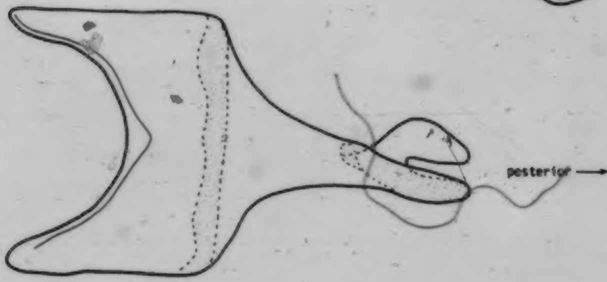
Figure 202. Tergum and sternum 8, left lateral aspect.


uncus
process of proximal arm of gnathos
tegumen
aedeagus
valvae
juxta
distal arm of gnathos
vinculum

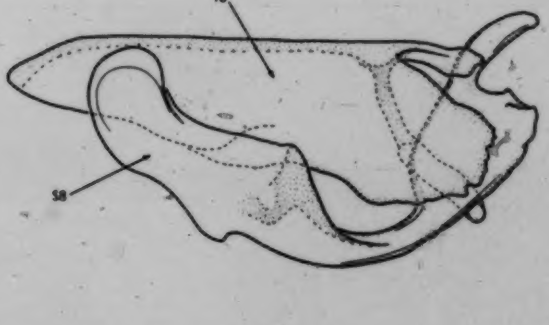
199



200



201



202

Figures 203 to 207. Structure of male genitalia and abdominal segment 8 of *Scythris basilaris* . Scale bars = 0.1 mm.

Figure 203. Genitalia, left lateral aspect; "bulbus ejac." = bulbus ejaculatorius; "ductus ejac." = ductus ejacularorius.

Figure 204. Genitalia, dorsal aspect.

Figure 205. Sternum 8, left lateral aspect.

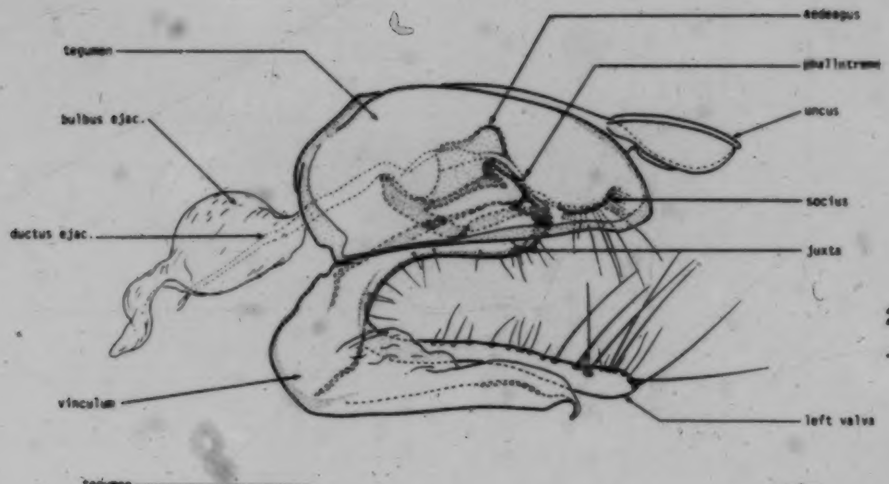
Figure 206. Sternum 8, dorsal aspect.

Figure 207. Tergum 8, dorsal aspect.

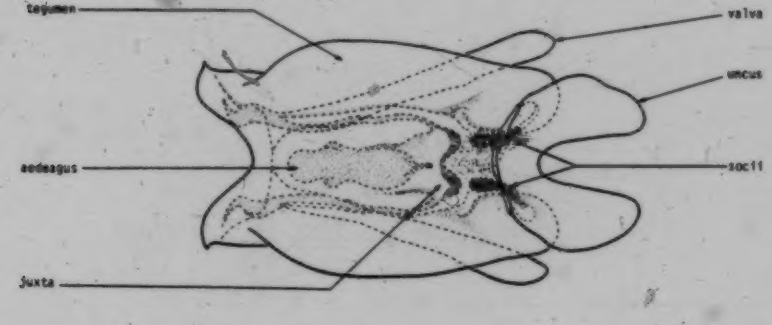
Figures 208 to 209. Structure of male abdominal segment 8 of *Scythris eboracensis* . Scale bars = 0.1 mm.

Figure 208. Tergum 8, dorsal aspect.

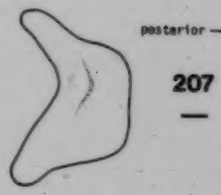
Figure 209. Sternum 8, dorsal aspect.


tegumen
bulbus ejac.
ductus ejac.
vinculum
aedeagus
phallotreme
uncus
socius
juxta
left valva

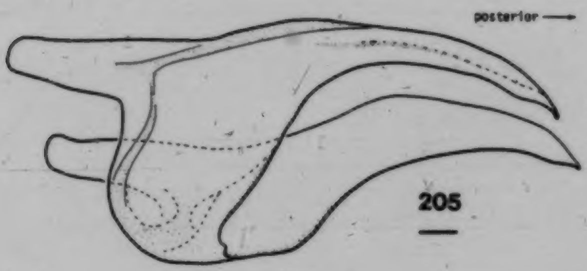
203


tegumen
aedeagus
juxta
valva
uncus
socii

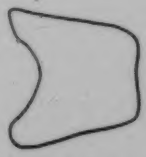
204



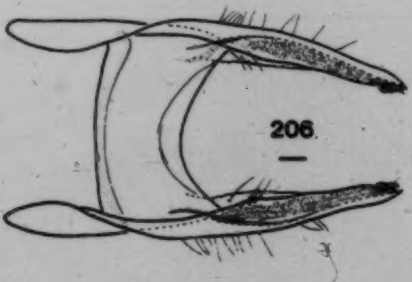
207



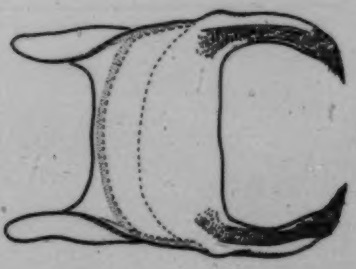
205



208



206



209

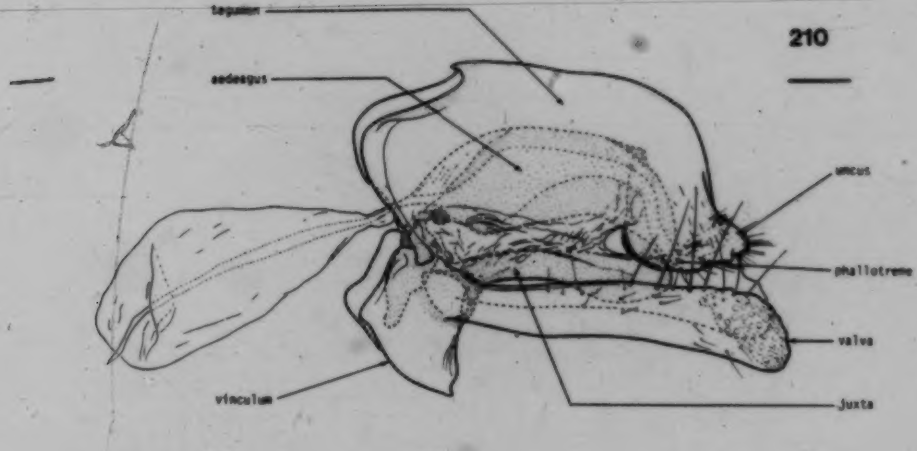
Figures 210 to 212. Structure of male genitalia and abdominal segment 8 of *Scythris interrupta*. Scale bars = 0.1 mm.

Figure 210. Genitalia, left lateral aspect.

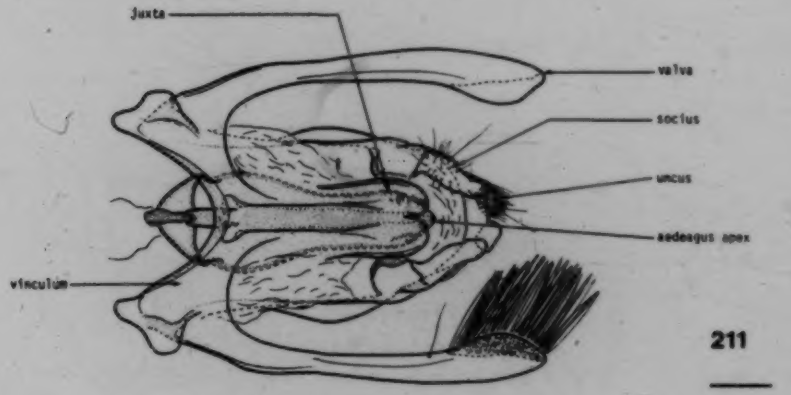
Figure 211. Genitalia, ventral aspect.

Figure 212. Sternum 8, ventral aspect.

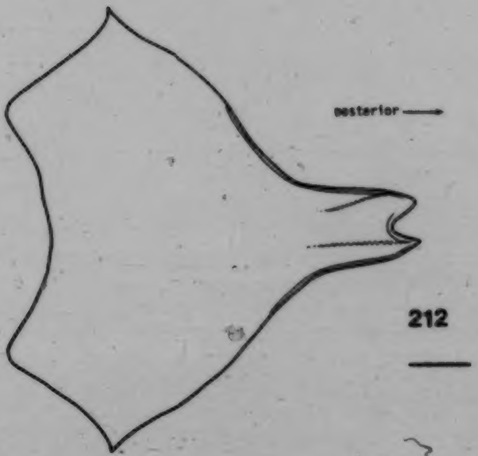
21


tegumen
aedeagus
uncus
phallotreme
valva
juxta
vinculum

210


juxta
valva
socius
uncus
aedeagus apex
vinculum

211


posterior →

212

Figures 213 to 215. Structure of male genitalia and tergum 8 of *Scythris inspersella* .

Scale bars = 0.1 mm.

Figure 213. Genitalia, left lateral aspect.

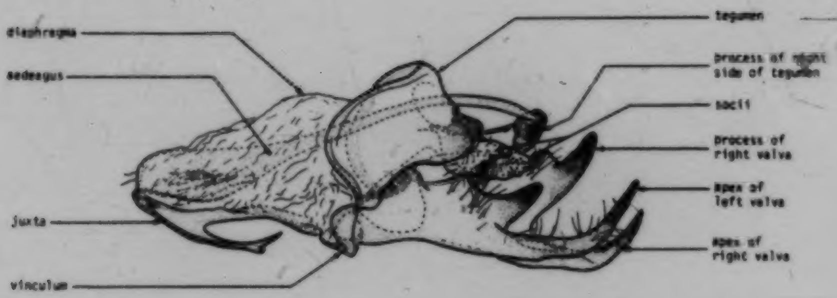
Figure 214. Genitalia, dorsal aspect; "bulbus ejac." = bulbus ejaculatorius.

Figure 215. Tergum 8, dorsal aspect.

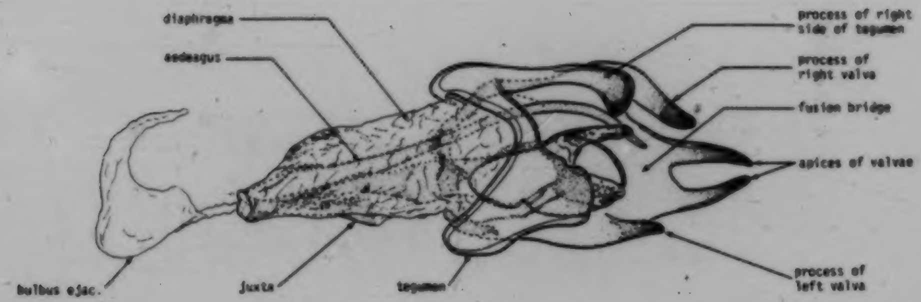
Figures 216 to 217. Structure of male abdominal segments 7 and 8 of *Scythris noricella* .

Figure 216. Tergum 8, dorsal aspect. Scale bars = 0.1 mm.

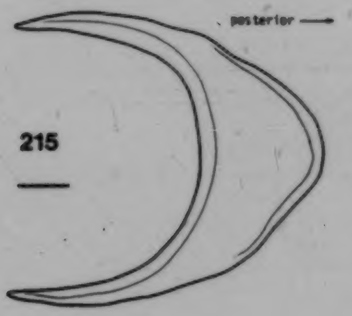
Figure 217. Sterna 7 and 8, ventral aspect (only left half of S8 shown).


diaphragma
aedeagus
juxta
vinculum
tegumen
process of right side of tegumen
socii
process of right valva
apex of left valva
apex of right valva

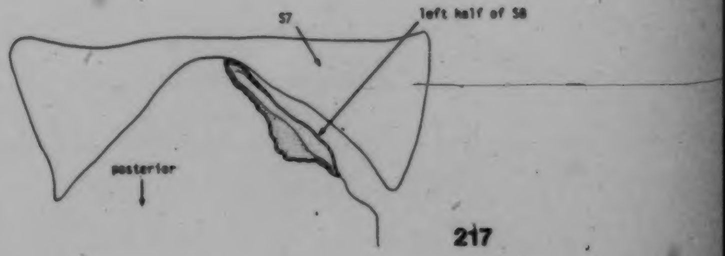
213


diaphragma
aedeagus
bulbus ejac.
juxta
tegumen
process of right side of tegumen
process of right valva
fusion bridge
apices of valvae
process of left valva

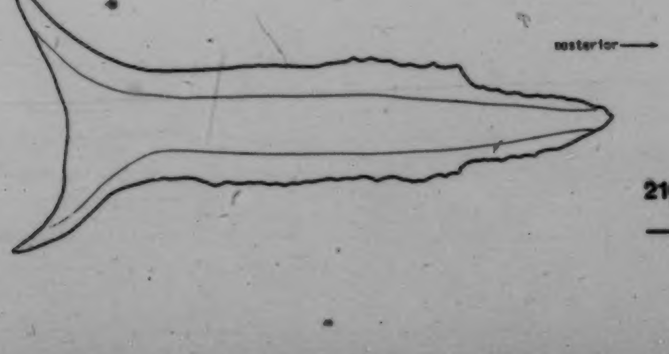
214



215


S7
left half of S8
posterior

217

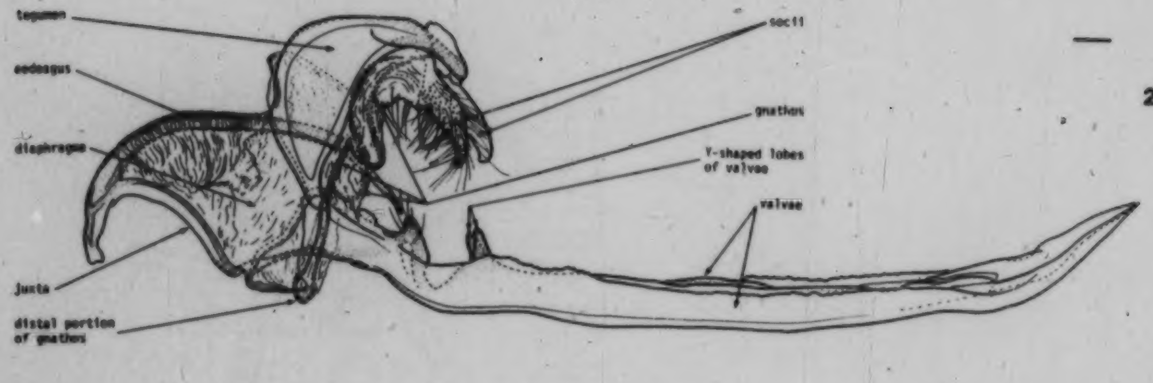


216

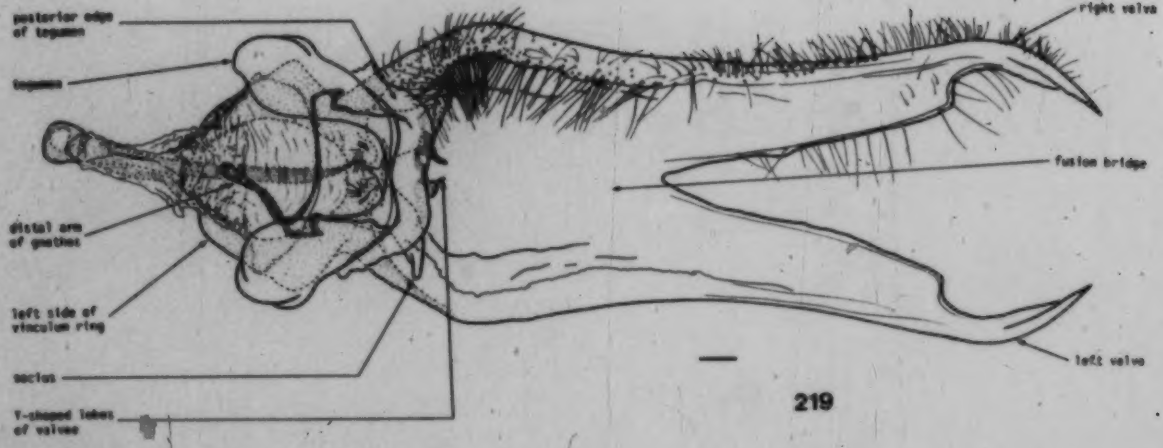
Figures 218 to 219. Structure of male genitalia of *Scythris noricella* . Scale bars = 0.1 mm.

Figure 218. Left lateral aspect.

Figure 219. Dorsal aspect.


tegumen
aedeagus
diaphragma
juxta
distal portion of gnathos
socii
gnathos
Y-shaped lobes of valvae
valvae

218


posterior edge of tegumen
tegumen
distal arm of gnathos
left side of vinculum ring
saccus
Y-shaped lobes of valvae
right valva
fusion bridge
left valva

219

Figures 220 to 223. Structure of male genitalia and tergum 8 of *Scythris anthracina* .

Scale bars = 0.1 mm.

Figure 220. Genitalia, left lateral aspect.

Figure 221. Genitalia, dorsal aspect.

Figure 222. Genitalia, ventral aspect, tilted (some dorsal parts and distal portion of valvae omitted).

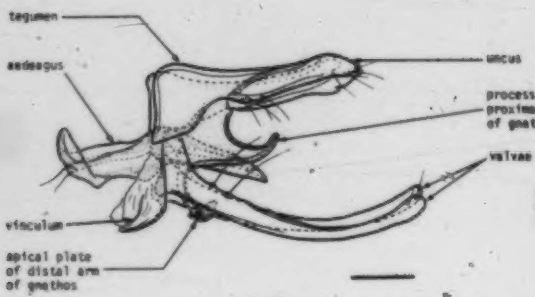
Figure 223. Tergum 8, dorsal aspect.

Figures 224 to 225. Structure of male genitalia of *Scythris inornatella* .

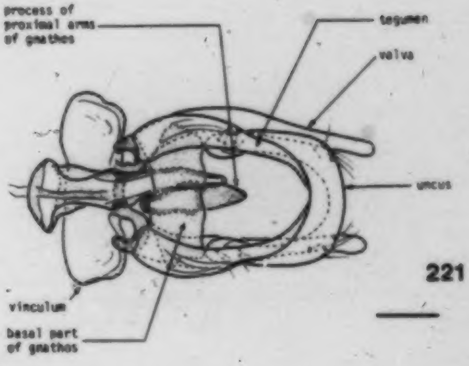
Scale bars = 0.1 mm.

Figure 224. Tegumen-uncus-gnathos, ventral aspect.

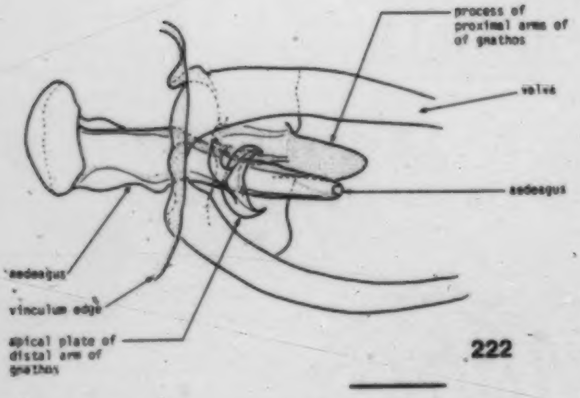
Figure 225. Valvae-aedeagus, dorsal aspect.


tegumen
aedeagus
uncus
process of proximal arms of gnathos
valvae
vinculum
apical plate of distal arm of gnathos

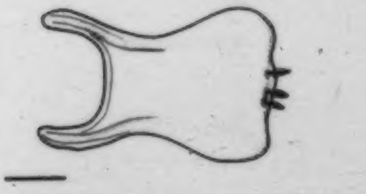
220


process of proximal arms of gnathos
tegumen
valva
uncus
vinculum
basal part of gnathos

221

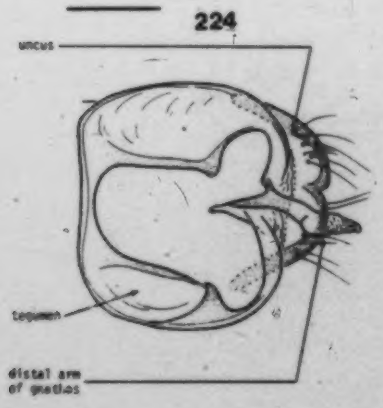

process of proximal arms of of gnathos
valva
aedeagus
aedeagus
vinculum edge
apical plate of distal arm of gnathos

222

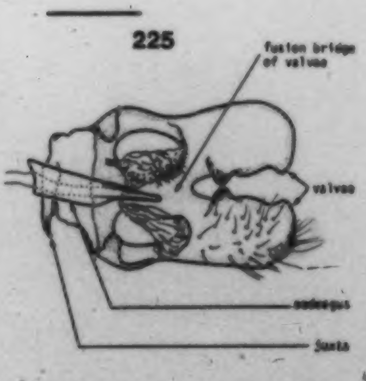


223

224


uncus
tegumen
distal arm of gnathos

225


fusion bridge of valvae
valvae
aedeagus
juxta

Figures 226 to 229. Structure of male genitalia and tergum 8 of *Scythris charon* .

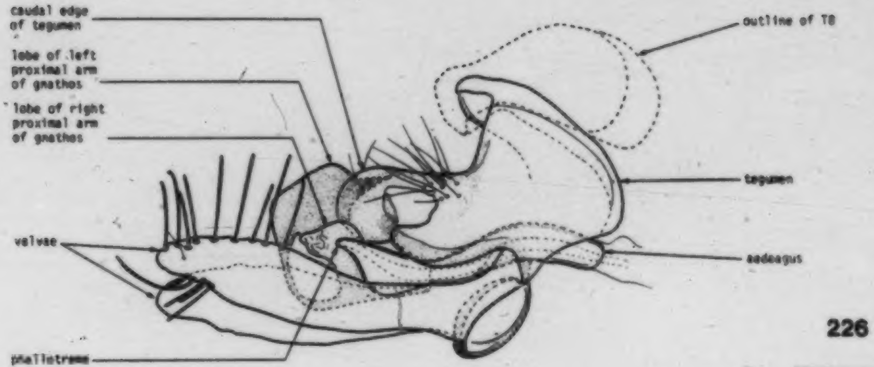
Scale bars = 0.1 mm.

Figure 226. Genitalia, right lateral aspect (tergum 8 also shown in outline).

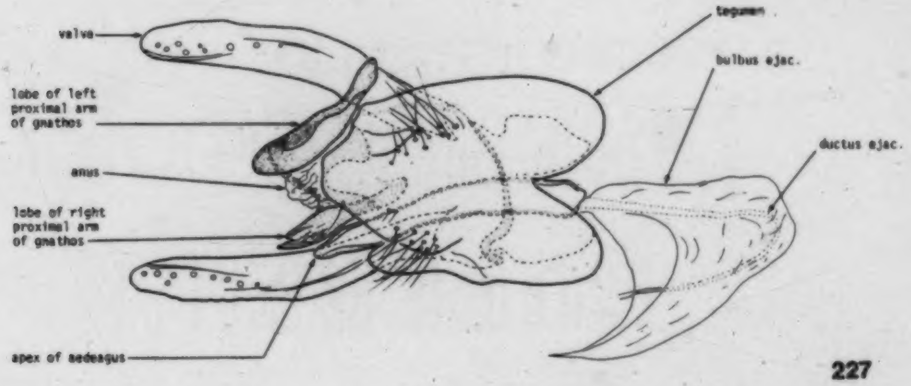
Figure 227. Genitalia, dorsal aspect; "bulbus ejac." = bulbus ejaculatorius; "ductus ejac." = ductus ejacularorius.

Figure 228. Tergum 8, dorsal aspect (outline of some parts of genitalia also shown).

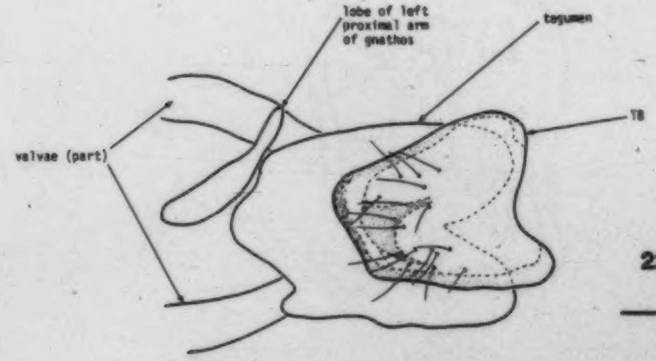
Figure 229. Tergum 8, right lateral aspect.


caudal edge of tegumen
lobe of left proximal arm of gnathos
lobe of right proximal arm of gnathos
valvae
phallotreme
outline of T8
tegumen
aedeagus

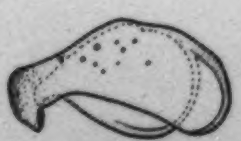
226


valva
lobe of left proximal arm of gnathos
anus
lobe of right proximal arm of gnathos
apex of aedeagus
tegumen
bulbus ejac.
ductus ejac.

227


lobe of left proximal arm of gnathos
tegumen
valvae (part)
T8

228



229

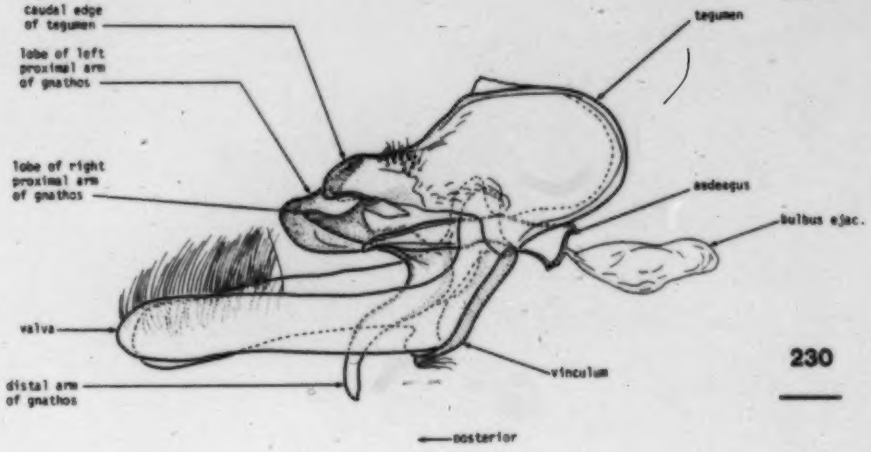
Figures 230 to 232. Structure of male genitalia and tergum 8 of *Areniscythris brachypteris* .

Scale bars = 0.1 mm.

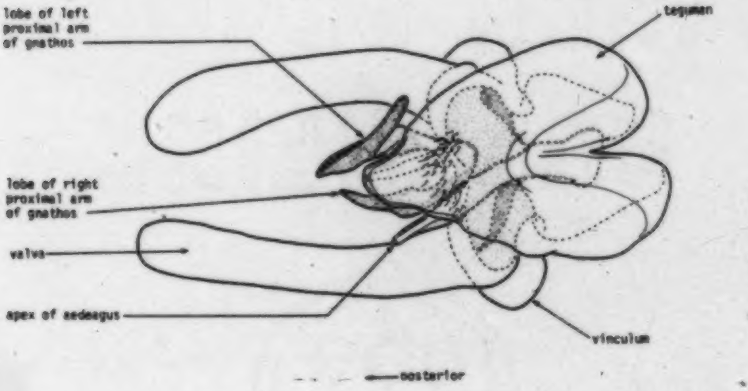
Figure 230. Genitalia, right lateral aspect; "bulbus ejac." = bulbus ejaculatorius.

Figure 231. Genitalia, dorsal aspect.

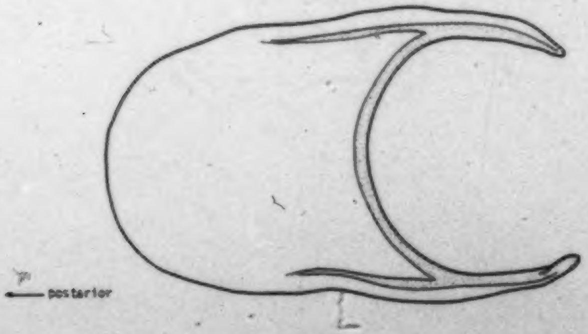
Figure 232. Tergum 8, dorsal aspect.


caudal edge
of tegumen
lobe of left
proximal arm
of gnathos
lobe of right
proximal arm
of gnathos
valva
distal arm
of gnathos
tegumen
aedeagus
bulbus ejac.
vinculum
posterior

230


lobe of left
proximal arm
of gnathos
lobe of right
proximal arm
of gnathos
valva
apex of aedeagus
tegumen
vinculum
posterior

231


posterior

232

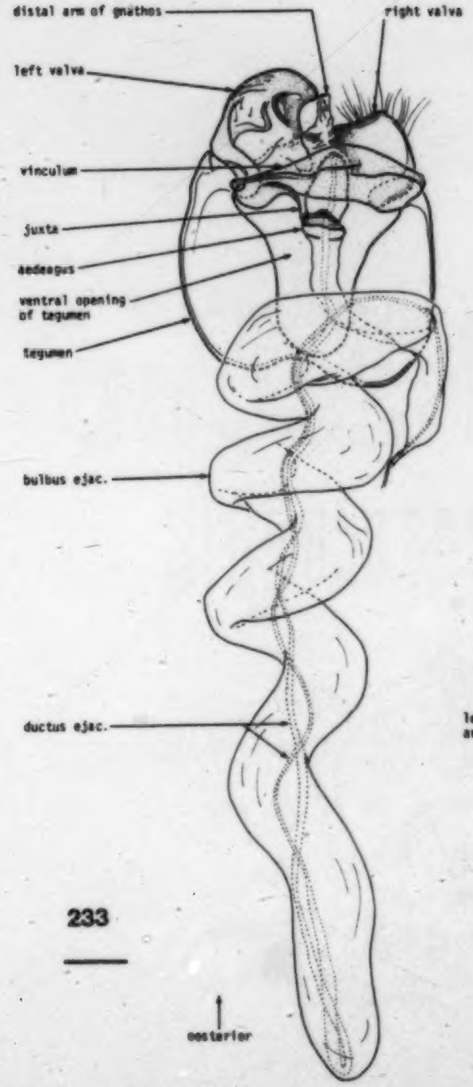
Figures 233 to 235. Structure of male genitalia of *Asymmetrura graminivorella* .

Scale bars = 0.1 mm.

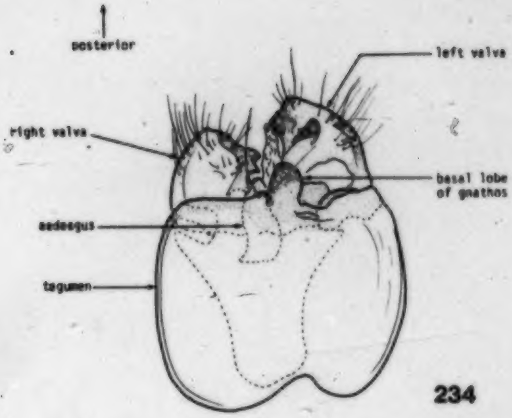
Figure 233. Ventral aspect; "bulbus ejac." = bulbus ejaculatorius; "ductus ejac." = ductus ejacularorius.

Figure 234. Dorsal aspect (bulbus ejaculatorius omitted).

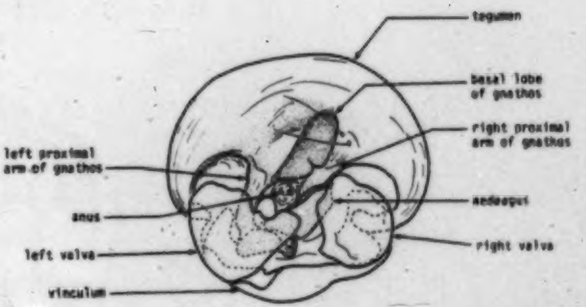
Figure 235. Caudal aspect.


distal arm of gnathos
right valva
left valva
vinculum
juxta
aedeagus
ventral opening of tagumen
tagumen
bulbus ejac.
ductus ejac.
posterior

233


posterior
left valva
right valva
basal lobe of gnathos
aedeagus
tagumen

234


tagumen
basal lobe of gnathos
right proximal arm of gnathos
left proximal arm of gnathos
aedeagus
anus
right valva
left valva
vinculum

235

Figures 236 to 239. Structure of male genitalia of *Asymmetrura matutella* .

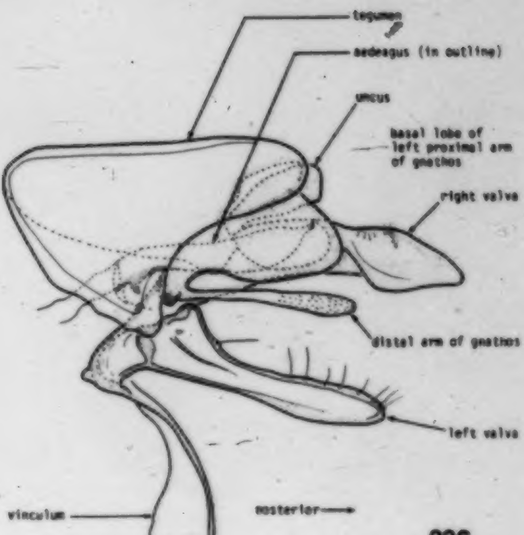
Scale bars = 0.1 mm.

Figure 236. Whole genitalia, left lateral aspect (bulbus ejaculatorius omitted).

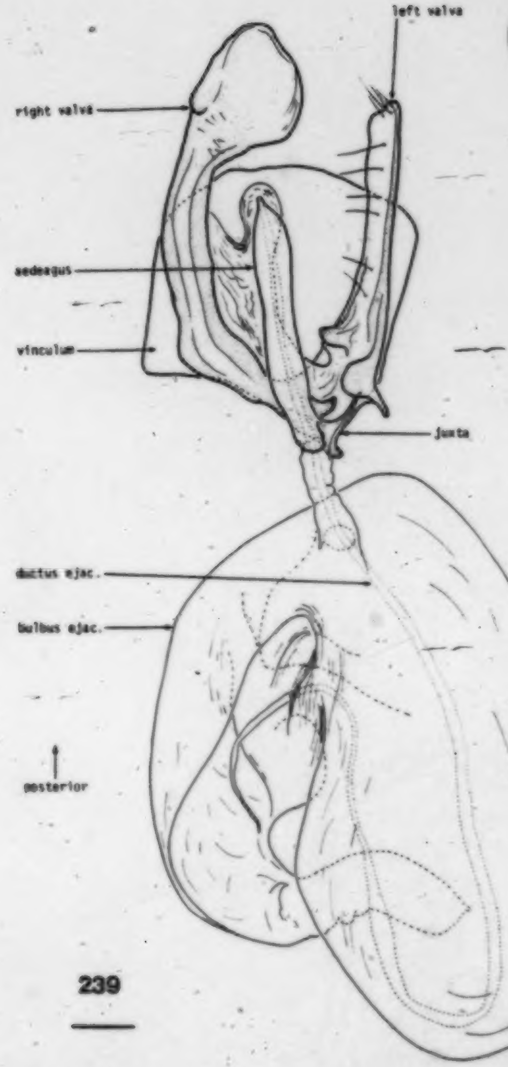
Figure 237. Tegumen-uncus-gnathos, caudal aspect.

Figure 238. Tegumen-uncus-gnathos, dorsal aspect.

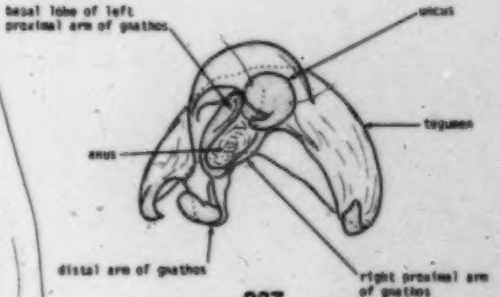
Figure 239. Vinculum-valvae-aedeagus, dorsal aspect; "bulbus ejac." = bulbus ejaculatorius; "ductus ejac." = ductus ejacularorius.


tegumen
aedeagus (in outline)
uncus
basal lobe of left proximal arm of gnathos
right valva
distal arm of gnathos
left valva
vinculum
posterior

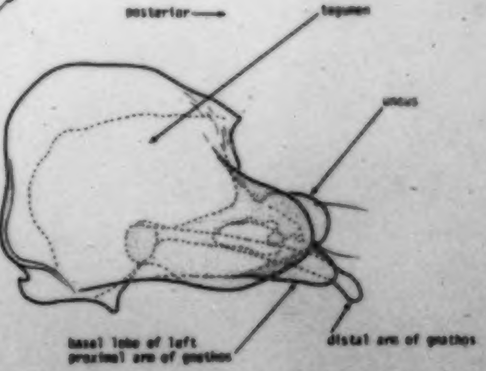
236


left valva
right valva
aedeagus
vinculum
juxta
ductus ejac.
bulbus ejac.
posterior

239


basal lobe of left proximal arm of gnathos
uncus
tegumen
anus
distal arm of gnathos
right proximal arm of gnathos

237


posterior
tegumen
uncus
basal lobe of left proximal arm of gnathos
distal arm of gnathos

238

Figures 240 to 244. Structure of male genitalia of *Asymmetrura impositella* ; Fig. 240 from a different specimen than Figs. 241-244. Scale bars = 0.1 mm.

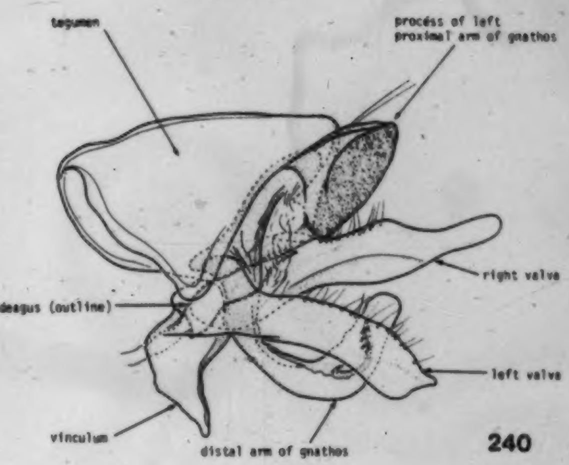
Figure 240. Whole genitalia, left lateral aspect (bulbus ejaculatorius omitted).

Figure 241. Tegumen-uncus-gnathos, caudal aspect.

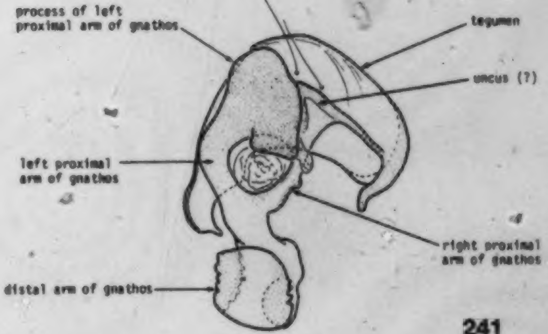
Figure 242. Tegumen-uncus-gnathos, dorsal aspect.

Figure 243. Tegumen-uncus-gnathos, right lateral aspect.

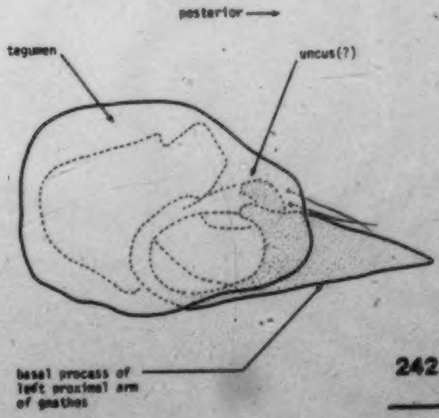
Figure 244. Vinculum-valvae-aedeagus, dorsal aspect; "bulbus ejac." = bulbus ejaculatorius; "ductus ejac." = ductus ejacularorius.


posterior
tegumen
process of left proximal arm of gnathos
right valva
aedeagus (outline)
left valva
vinculum
distal arm of gnathos

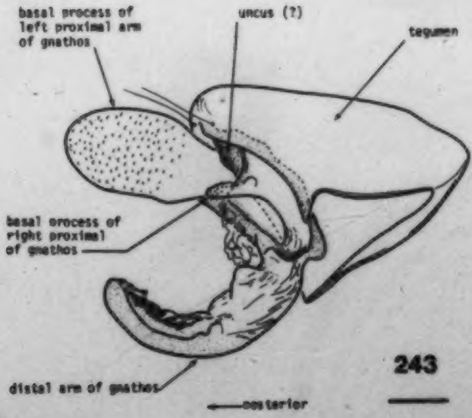
240


process of left proximal arm of gnathos
tegumen
uncus (?)
left proximal arm of gnathos
right proximal arm of gnathos
distal arm of gnathos

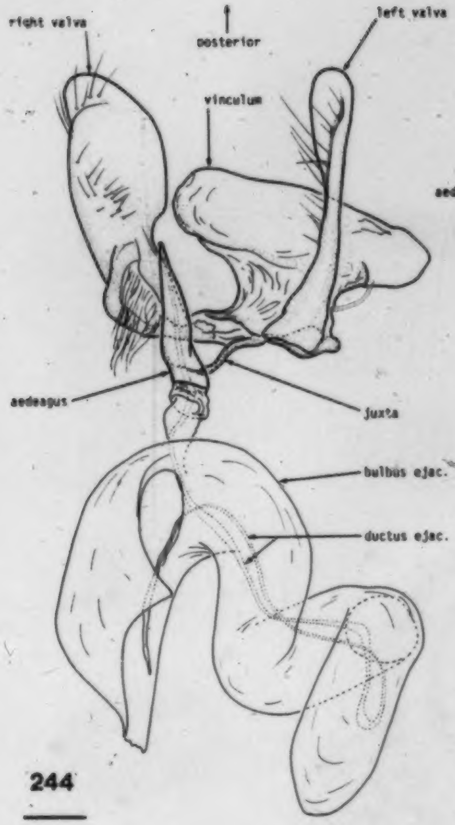
241


posterior
tegumen
uncus(?)
basal process of left proximal arm of gnathos

242


basal process of left proximal arm of gnathos
uncus (?)
tegumen
basal process of right proximal of gnathos
distal arm of gnathos
posterior

243


right valva
posterior
left valva
vinculum
aedeagus
juxta
bulbus ejac.
ductus ejac.

244

Figures 245 to 247. Structure of male genitalia of *Asymmetrura reducta* .

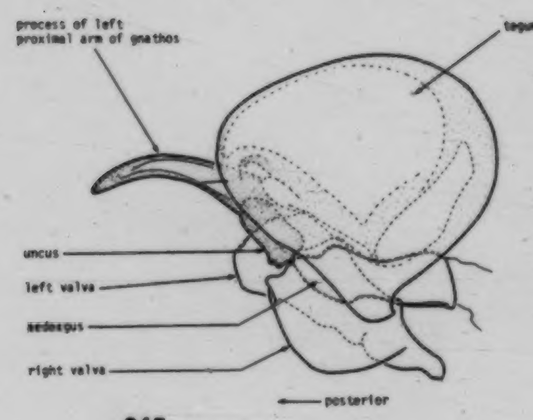
Scale bars = 0.1 mm.

Figure 245. Whole genitalia, right lateral aspect (bulbus ejaculatorius omitted).

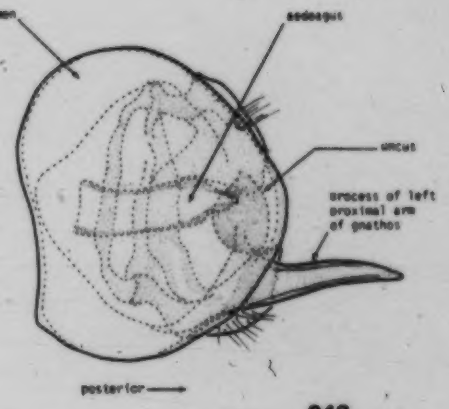
Figure 246. Whole genitalia, dorsal aspect (bulbus ejaculatorius omitted).

Figure 247. Whole genitalia, ventral aspect; "bulbus ejac." = bulbus ejaculatorius; "ductus ejac." = ductus ejacularorius.

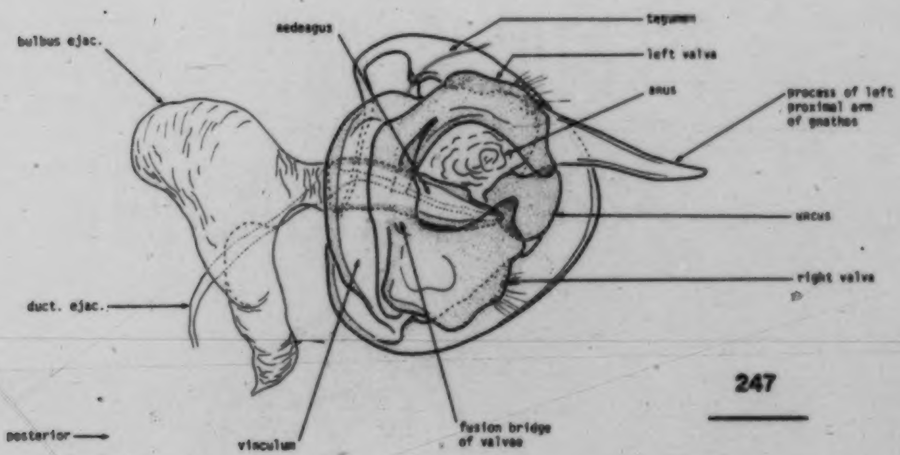
Figure 248. Structure of male genitalia of *Asymmetrura scintillifera* , left lateral aspect; "bulbus ejac." = bulbus ejaculatorius.


process of left
proximal arm of gnathos
tegumen
uncus
left valva
aedeagus
right valva
← posterior

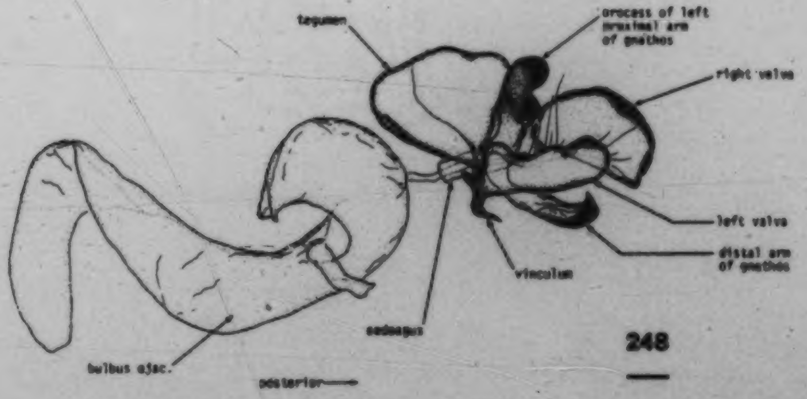
245


aedeagus
uncus
process of left
proximal arm
of gnathos
posterior →

246


aedeagus
tegumen
left valva
bulbus ejac.
anus
process of left
proximal arm
of gnathos
uncus
right valva
duct. ejac.
posterior →
vinculum
fusion bridge
of valvae

247


tegumen
process of left
proximal arm
of gnathos
right valva
left valva
distal arm
of gnathos
vinculum
aedeagus
bulbus ejac.
posterior →

248

Figures 249 to 254. Structure of male genitalia and abdominal segment 8 of *Neoscythris fissirostris* . Scale bars = 0.1 mm.

Figure 249. Genitalia, right lateral aspect; "bulbus ejac." = bulbus ejaculatorius.

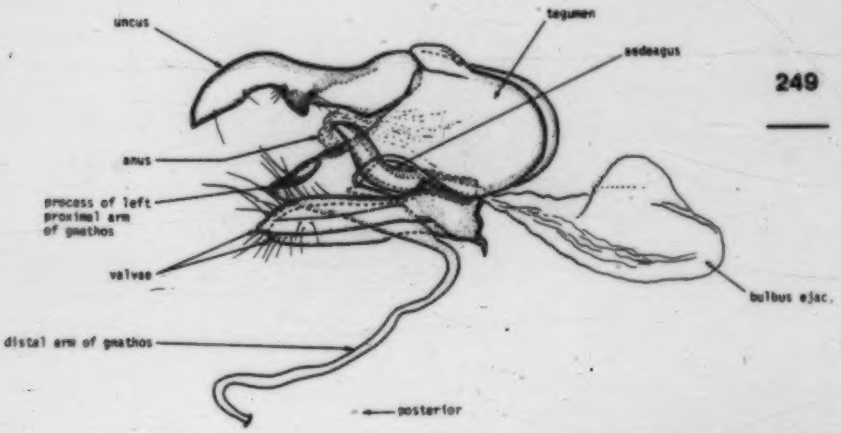
Figure 250. Genitalia, ventral aspect.

Figure 251. Genitalia, dorsal aspect.

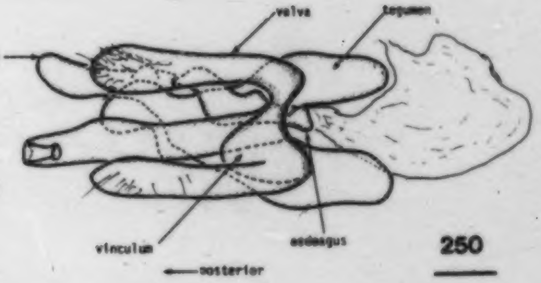
Figure 252. Genitalia, caudal aspect.

Figure 253. Tergum 8, dorsal aspect.

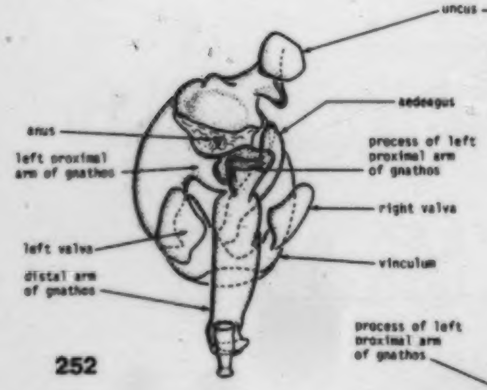
Figure 254. Sternum 8, ventral aspect.


uncus
tegumen
aedeagus
anus
process of left proximal arm of gnathos
valvae
bulbus ejac.
distal arm of gnathos
← posterior

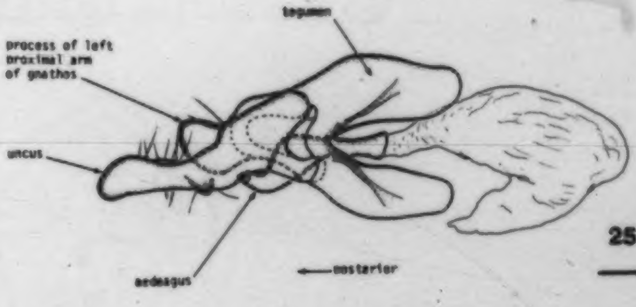
249


valva
tegumen
vinculum
aedeagus
← posterior

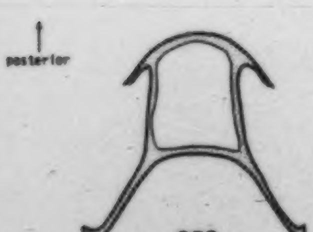
250


uncus
aedeagus
anus
left proximal arm of gnathos
process of left proximal arm of gnathos
right valva
left valva
vinculum
distal arm of gnathos

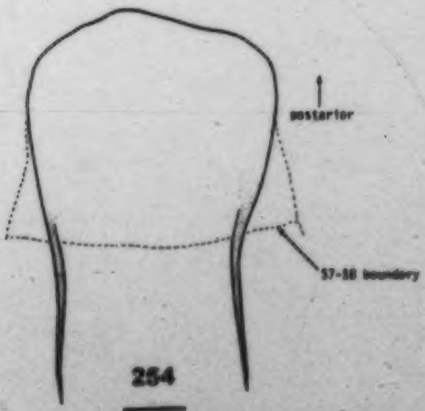
252


tegumen
process of left proximal arm of gnathos
uncus
aedeagus
← posterior

251



253


↑
posterior
S7-S8 boundary

254

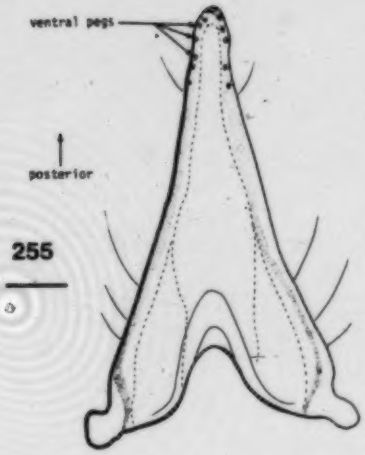
Figures 255 to 258. Structure of male genitalia and abdominal segment 8 of *Neoscythris confinis*. Scale bars = 0.1 mm.

Figure 255. Tergum 8, dorsal aspect.

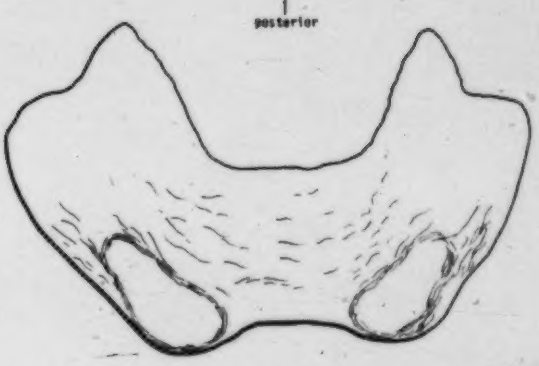
Figure 256. Sternum 8, ventral aspect.

Figure 257. Genitalia, left lateral aspect; "bulbus ejac." = bulbus ejaculatorius.

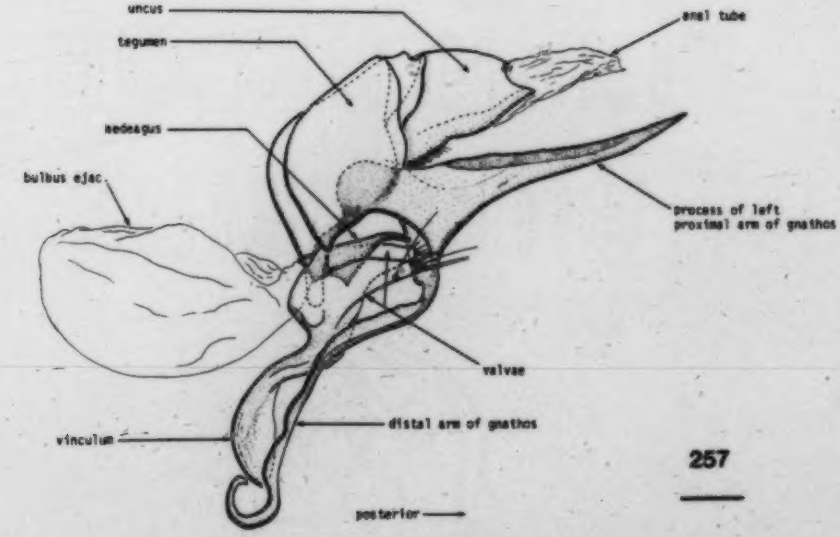
Figure 258. Genitalia, ventral aspect.


ventral pegs
posterior

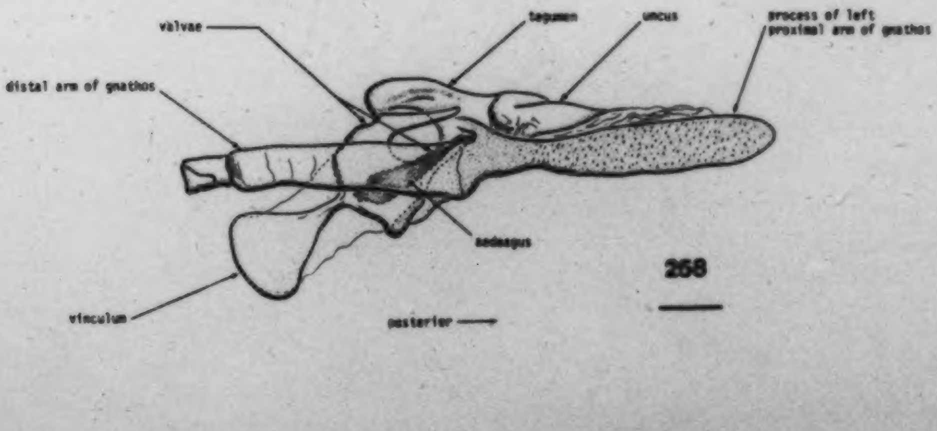
255



256


uncus
anal tube
tegumen
aedeagus
bulbus ejac.
process of left proximal arm of gnathos
valvae
distal arm of gnathos
vinculum
posterior

257


tegumen
uncus
process of left proximal arm of gnathos
valvae
distal arm of gnathos
aedeagus
vinculum
posterior

258

Figures 259 to 262. Structure of male genitalia of *Neoscythris planipenella* .

Scale bars = 0.1 mm.

Figure 259. Right lateral aspect; "ductus ejac." = ductus ejacularorius.

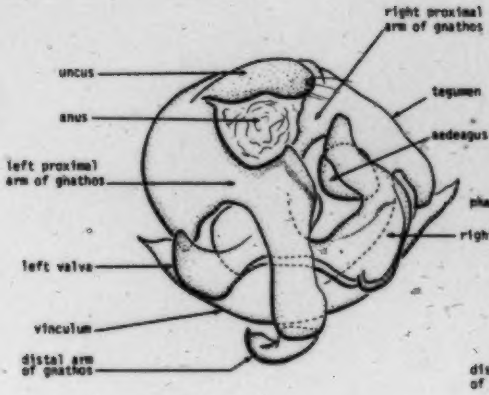
Figure 260. Left lateral aspect.

Figure 261. Caudal aspect.

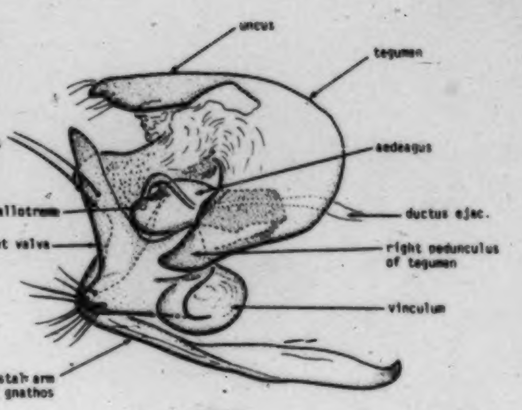
Figure 262. Dorsal aspect.

Figure 263. Structure of male tergum 8 of *Rhamphura altisierrae* , dorsal aspect.

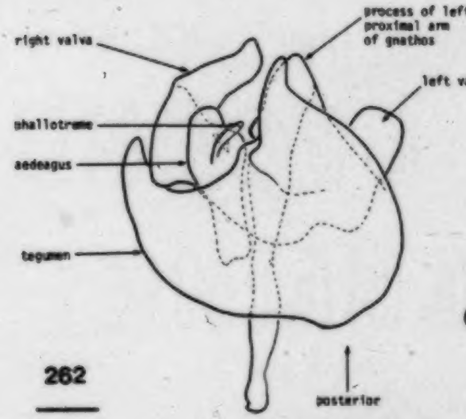
Scale bar = 0.1 mm.


right proximal arm of gnathos
uncus
tegumen
anus
aedeagus
left proximal arm of gnathos
right valva
left valva
vinculum
distal arm of gnathos

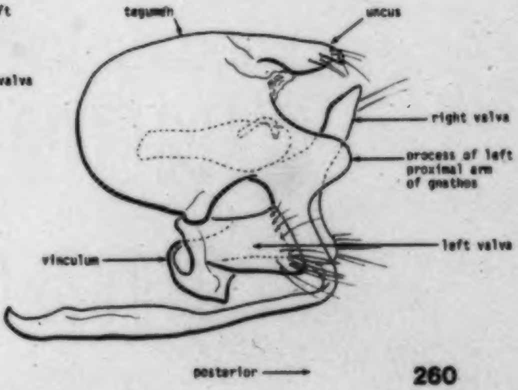
261


uncus
tegumen
aedeagus
phallotreme
ductus ejac.
right valva
right pedunculus of tegumen
vinculum
distal arm of gnathos
posterior

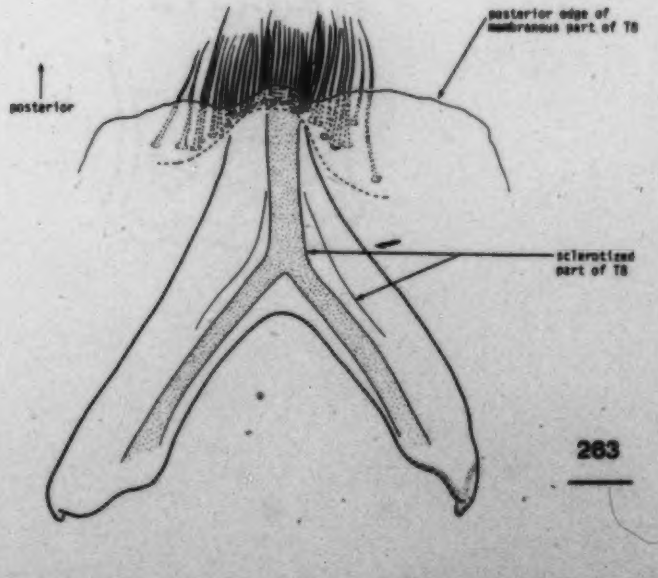
259


process of left proximal arm of gnathos
right valva
left valva
phallotreme
aedeagus
tegumen
posterior

262


tegumen
uncus
right valva
process of left proximal arm of gnathos
vinculum
left valva
posterior

260


posterior edge of membranous part of T8
posterior
sclerotized part of T8

263

Figures 264 to 267. Structure of male genitalia and abdominal tergum 8 of *Colinita sponsella*

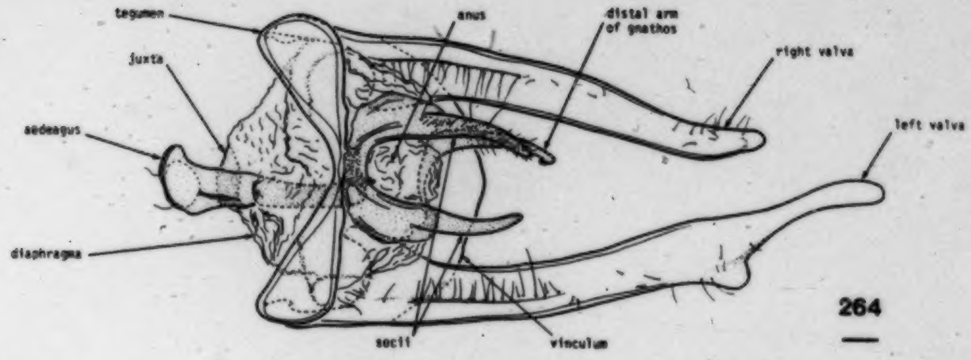
. Scale bars = 0.1 mm.

Figure 264. Genitalia, dorsal aspect (intersegmental membrane T8-tegumen omitted).

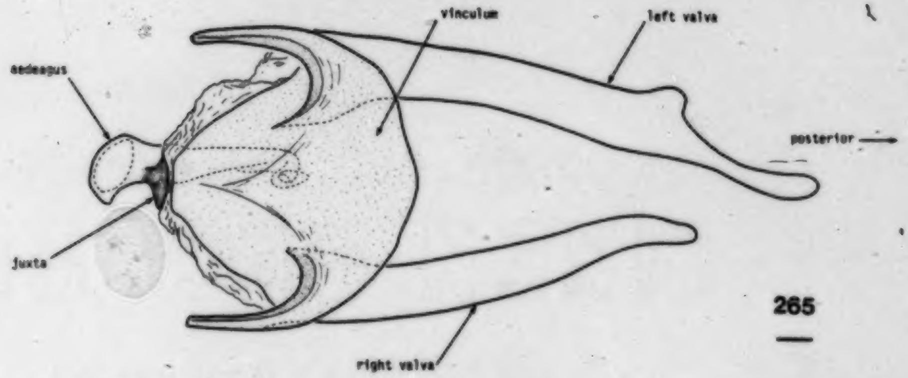
Figure 265. Genitalia, ventral aspect.

Figure 266. Tergum 8 and intersegmental membrane T8-tegumen, dorsal aspect.

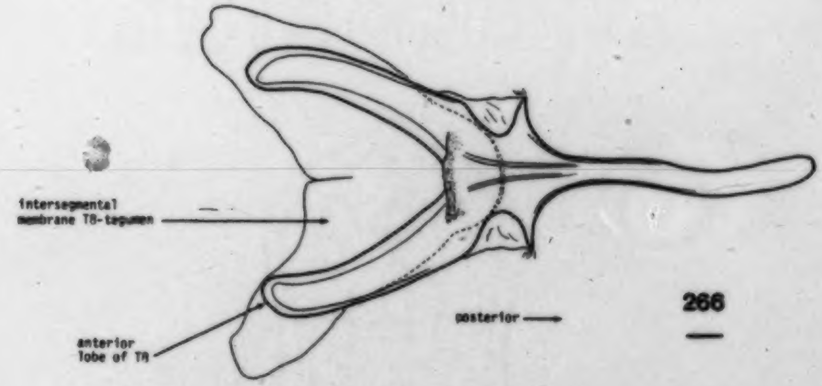
Figure 267. Tergum 8 and genitalia, left lateral aspect.


tegumen
anus
distal arm of gnathos
juxta
right valva
aedeagus
left valva
diaphragma
socii
vinculum

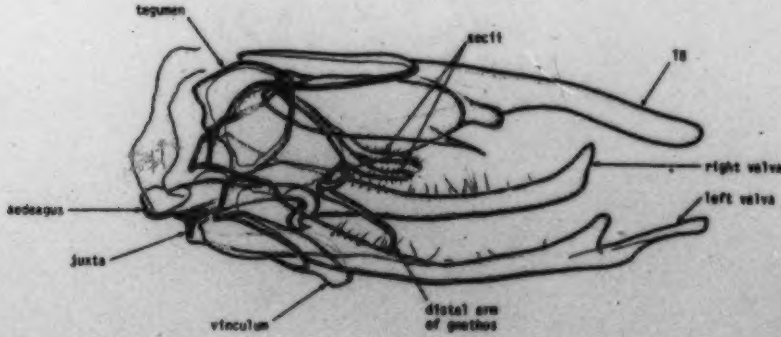
264


vinculum
left valva
aedeagus
posterior →
juxta
right valva

265


intersegmental membrane T8-tegumen
posterior →
anterior lobe of T8

266


tegumen
socii
T8
right valva
aedeagus
left valva
juxta
vinculum
distal arm of gnathos

267

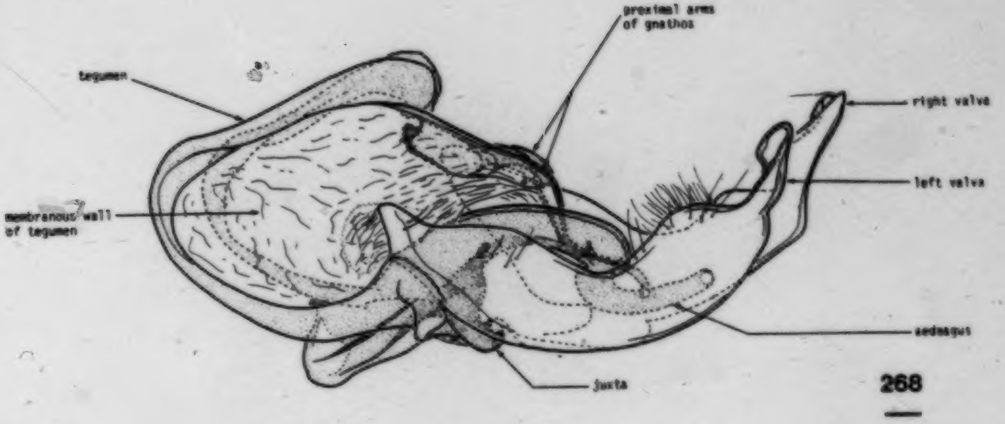
Figures 268 to 271. Structure of male genitalia and abdominal tergum 8 of *Hyalinixys sinuosa*. Scale bars = 0.1 mm.

Figure 268. Genitalia, left lateral aspect (intersegmental membrane T8-tegumen omitted).

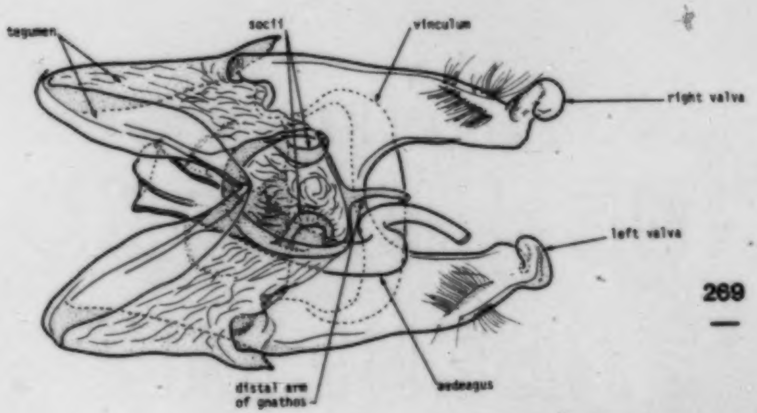
Figure 269. Genitalia, dorsal aspect.

Figure 270. Genitalia, ventral aspect.

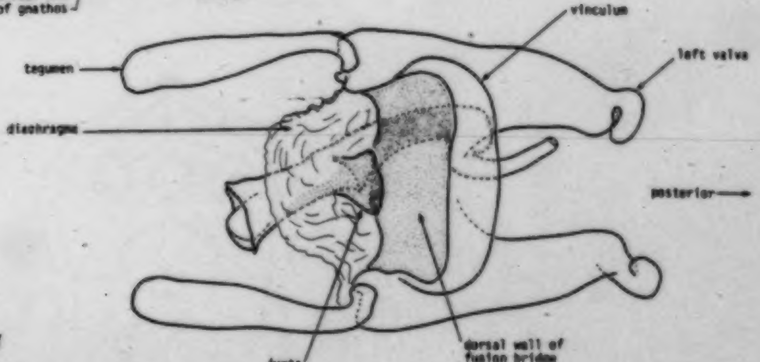
Figure 271. Tergum 8, dorsal aspect.


proximal arms of gnathos
tegumen
right valva
left valva
membranous wall of tegumen
aedeagus
juxta

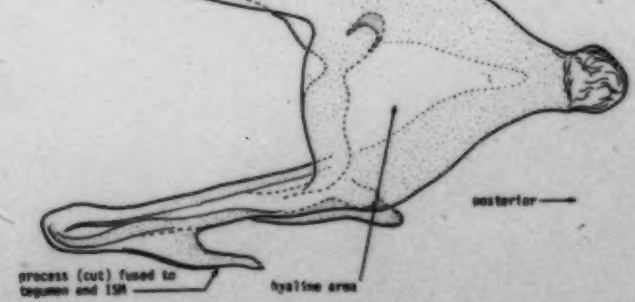
268


tegumen
socii
vinculum
right valva
left valva
distal arm of gnathos
aedeagus

269


vinculum
left valva
tegumen
diaphragma
posterior
juxta
dorsal wall of fusion bridge of valvae

270


posterior
process (cut) fused to tegumen and ISM
hyaline area

271

Figures 272 to 276. Structure of male genitalia and abdominal tergum 8 of *Meniscotus balli* .

Scale bars = 0.1 mm.

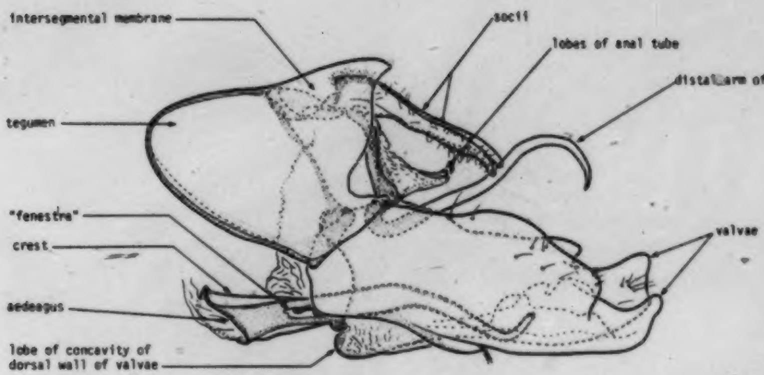
Figure 272. Genitalia, left lateral aspect.

Figure 273. Genitalia, dorsal aspect (intersegmental membrane T8-tegumen omitted).

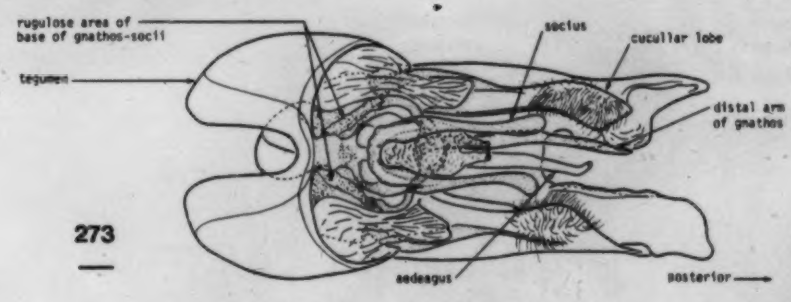
Figure 274. Genitalia, ventral aspect.

Figure 275. Tergum 8, dorsal aspect.

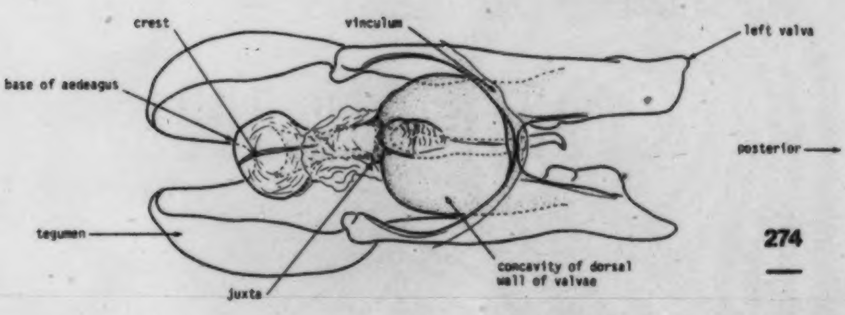
Figure 276. Tergum 8, left lateral aspect.


intersegmental membrane
socii
lobes of anal tube
distal arm of gnathos
tegumen
"fenestra"
crest
valvae
aedeagus
lobe of concavity of dorsal wall of valvae

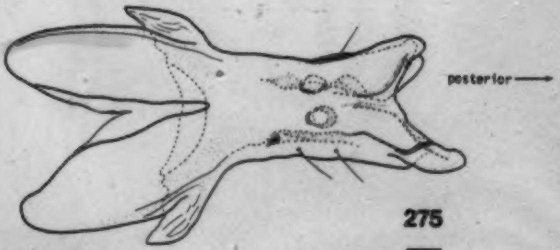
272


rugulose area of base of gnathos-socii
socius
cucullar lobe
tegumen
distal arm of gnathos
aedeagus
posterior

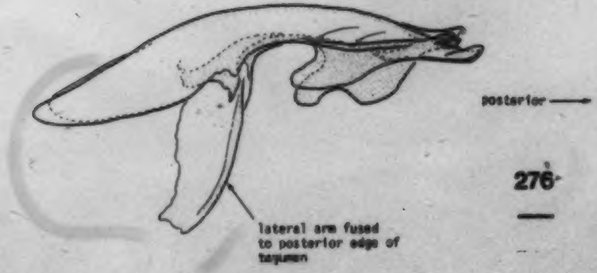
273


crest
vinculum
left valva
base of aedeagus
posterior
tegumen
concavity of dorsal wall of valvae
juxta

274



275


posterior
lateral arm fused to posterior edge of tegumen

276

Figures 277 to 281. Structure of male genitalia and abdominal tergum 8 of *Arotrura eburnea*. Scale bars = 0.5 mm (note scales different from those of other male genitalia figures).

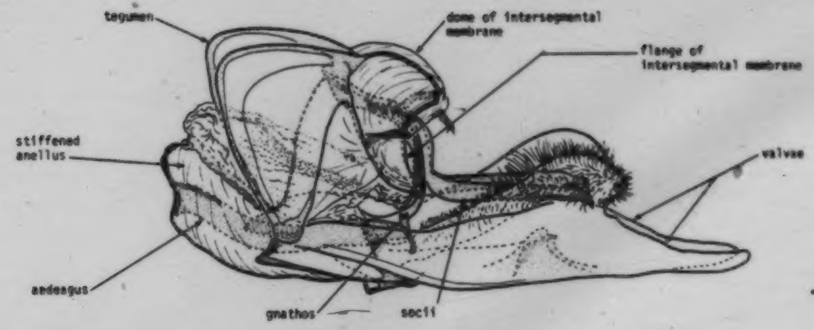
Figure 277. Genitalia, left lateral aspect.

Figure 278. Genitalia, dorsal aspect.

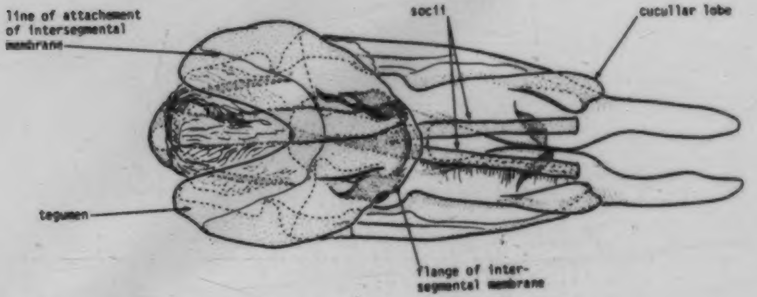
Figure 279. Genitalia, ventral aspect.

Figure 280. Tergum 8, dorsal aspect.

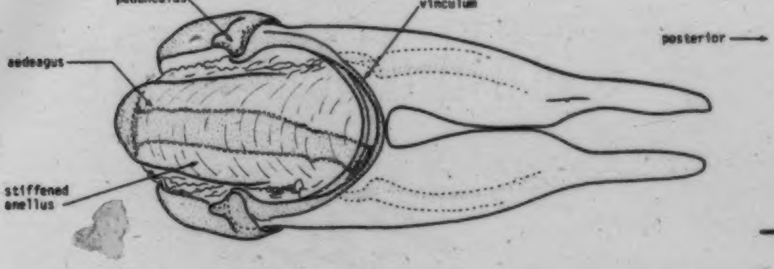
Figure 281. Tergum 8, left lateral aspect.


tegumen
dome of intersegmental membrane
flange of intersegmental membrane
stiffened anellus
valvae
aedeagus
gnathos
socii

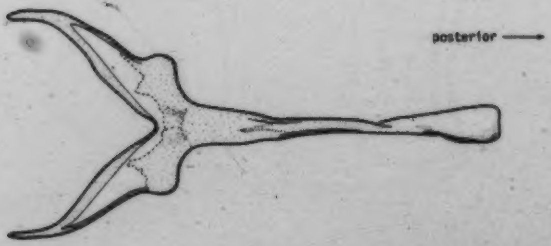
277


line of attachement of intersegmental membrane
socii
cucullar lobe
tegumen
flange of inter-segmental membrane

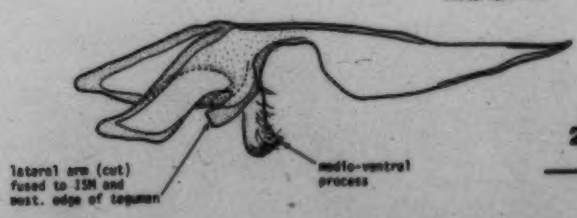
278


pedunculus
vinculum
posterior →
aedeagus
stiffened anellus

279



280


posterior →
lateral arm (cut) fused to ISM and post. edge of tegumen
medio-ventral process

281

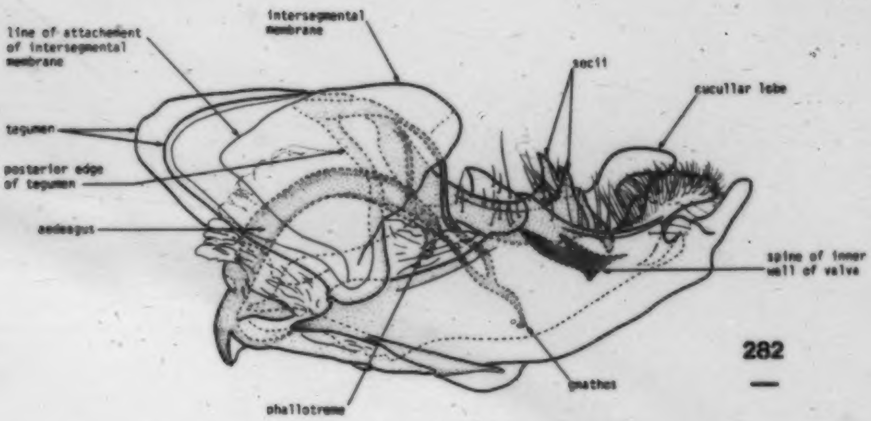
Figures 282 to 284. Structure of male genitalia of *Aeciatus formidabilis* .

Scale bars = 0.1 mm.

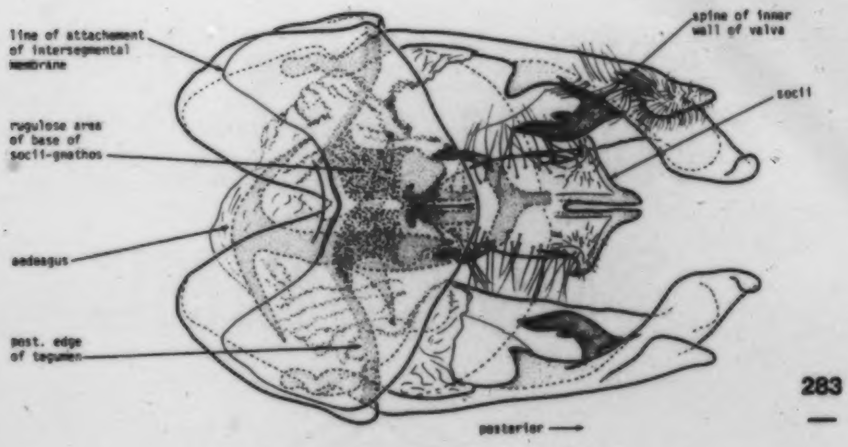
Figure 282. Left lateral aspect.

Figure 283. Dorsal aspect.

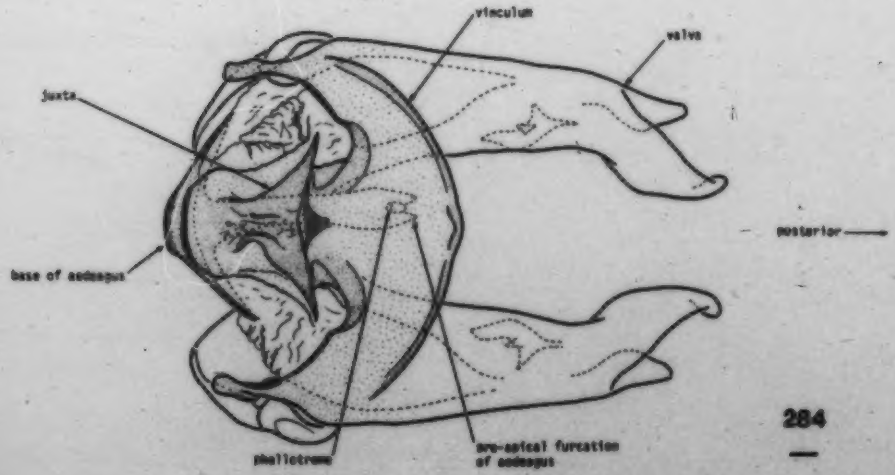
Figure 284. Ventral aspect.


line of attachement
of intersegmental
membrane
intersegmental
membrane
socii
cucullar lobe
tegumen
posterior edge
of tegumen
aedeagus
spine of inner
wall of valva
gnathos
phallotreme

282


line of attachement
of intersegmental
membrane
spine of inner
wall of valva
socii
rugulose area
of base of
socii-gnathos
aedeagus
post. edge
of tegumen
posterior ⟶

283


vinculum
valva
juxta
posterior ⟶
base of aedeagus
phallotreme
pre-apical furcation
of aedeagus

284

Figures 285 to 288. Structure of male genitalia and abdominal tergum 8 of *Mimiella divaricata*

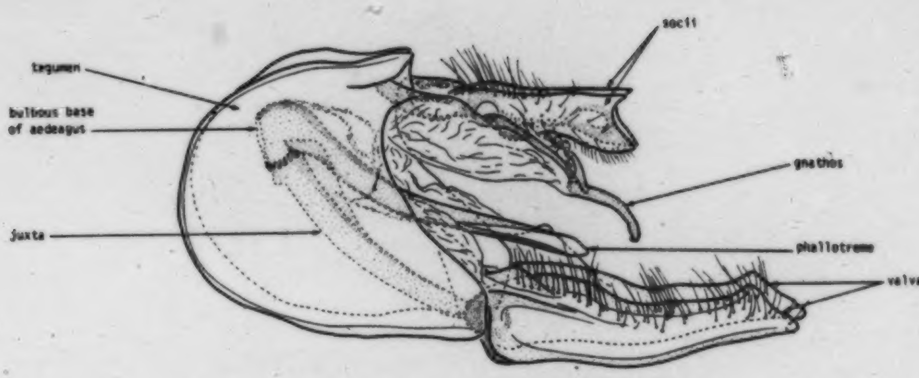
. Scale bars = 0.1 mm.

Figure 285. Genitalia, left lateral aspect (intersegmental membrane T8-tegumen omitted).

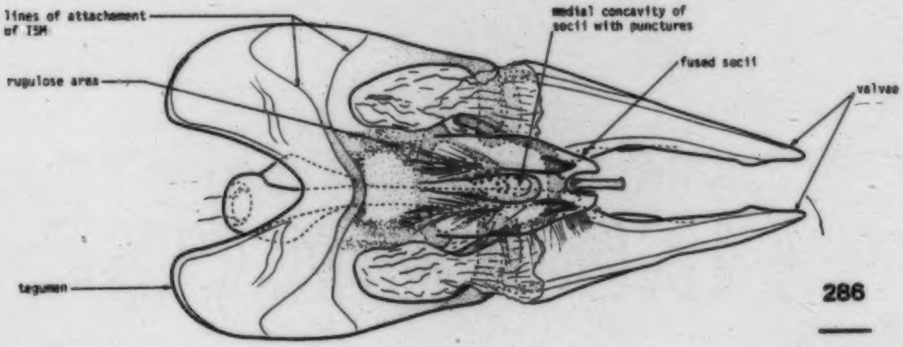
Figure 286. Genitalia, dorsal aspect (intersegmental membrane T8-tegumen omitted).

Figure 287. Genitalia, ventral aspect (anterior portion of tegumen and juxta omitted).

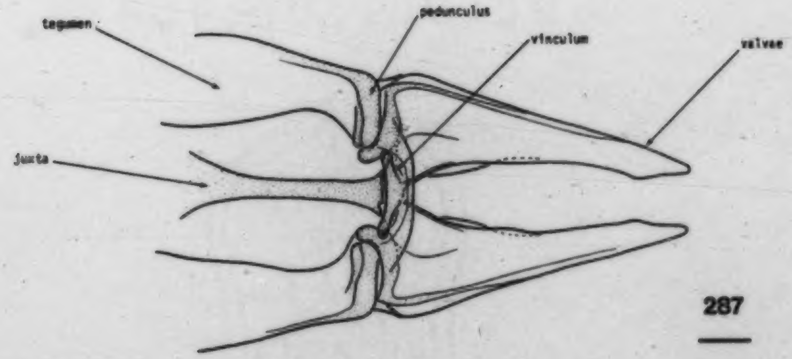
Figure 288. Tergum 8, dorsal aspect.


socii
tegumen
bulbous base
of aedeagus
gnathos
juxta
phallotreme
valvae

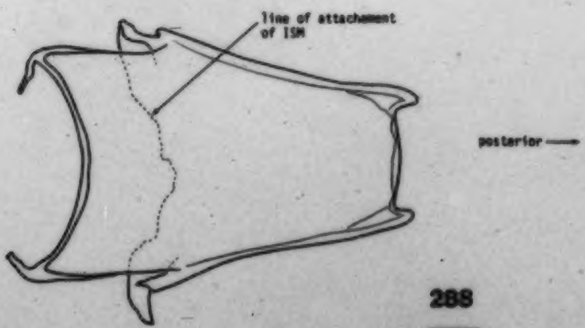
285


lines of attachement
of ISM
medial concavity of
socii with punctures
fused socii
rugulose area
valvae
tegumen

286


pedunculus
tegumen
vinculum
valvae
juxta

287


line of attachement
of ISM
posterior

288

Figures 289 to 292. Structure of male genitalia and abdominal tergum 8 of *Oncoxystus longissimus*. Scale bars = 0.1 mm.

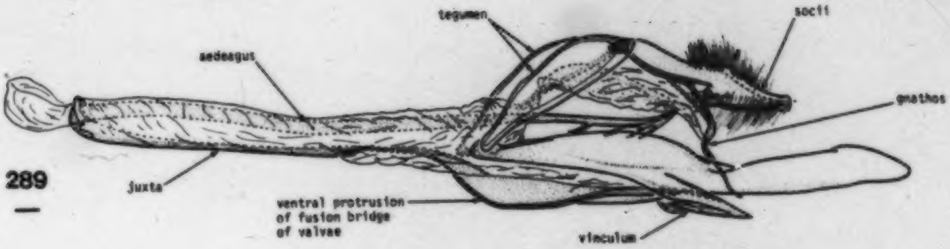
Figure 289. Genitalia, left lateral aspect (intersegmental membrane T8-tegumen omitted).

Figure 290. Genitalia, dorsal aspect (intersegmental membrane T8-tegumen omitted).

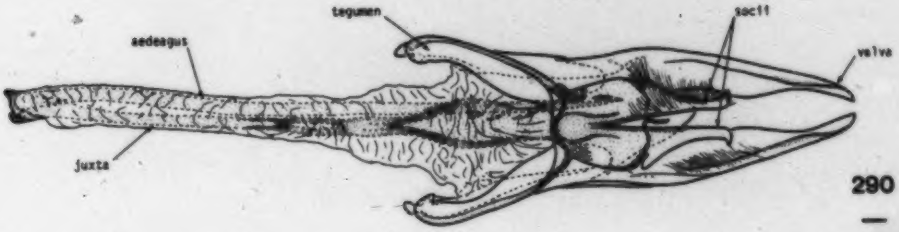
Figure 291. Genitalia, ventral aspect (anterior portion of juxta and aedeagus omitted).

Figure 292. Tergum 8, dorsal aspect.

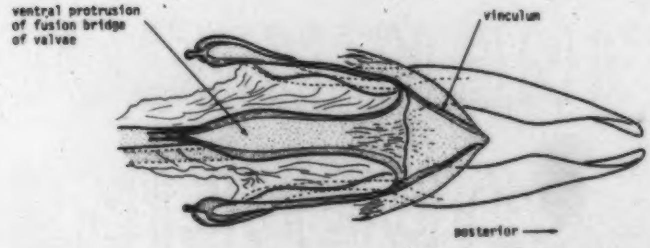
Figure 293. Structure of male abdominal tergum 8 of *Aeciatus formidabilis*, dorsal aspect. Scale bar = 0.1 mm.


tegumen
socii
aedeagus
gnathos
juxta
ventral protrusion
of fusion bridge
of valvae
vinculum

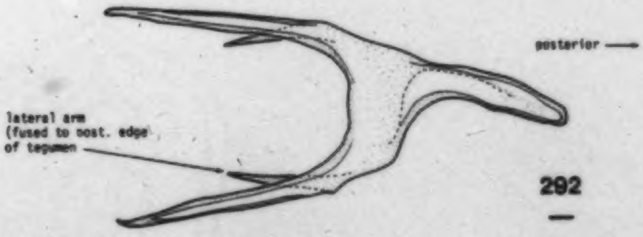
289


tegumen
socii
aedeagus
valva
juxta

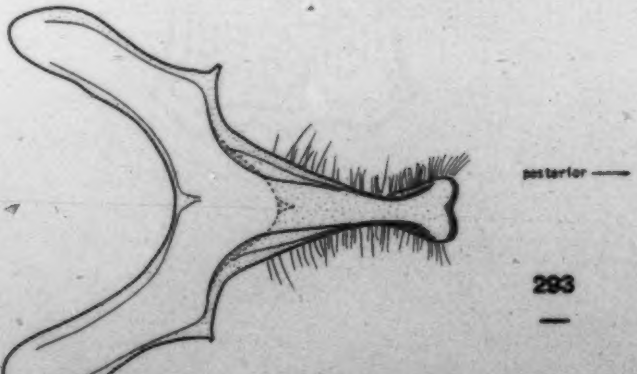
290


ventral protrusion
of fusion bridge
of valvae
vinculum
posterior

291


posterior
lateral arm
(fused to post. edge
of tegumen

292



293

Figures 294 to 298. Structure of male genitalia and abdominal tergum 8 of *Commodes radulatus*. Scale bars = 0.1 mm.

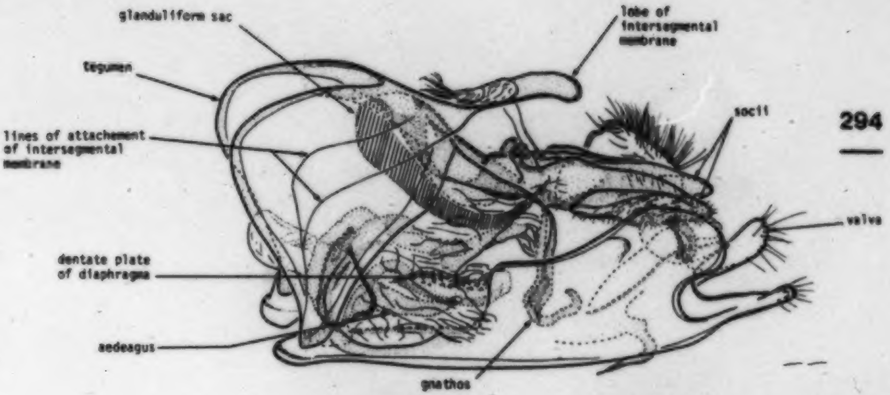
Figure 294. Genitalia, left lateral aspect (glanduliform sac of tegumen shown in cross-hatched outline).

Figure 295. Genitalia, dorsal aspect; "bulbus ejac." = bulbus ejaculatorius.

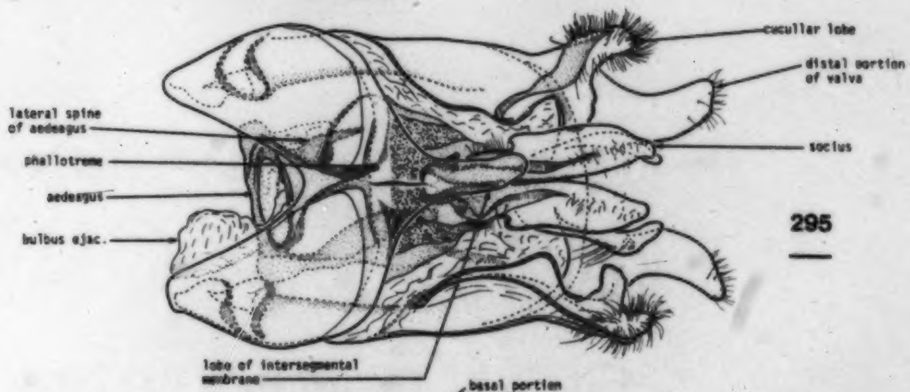
Figure 296. Genitalia, ventral aspect.

Figure 297. Glanduliform sac of tegumen, showing appearance of surface.

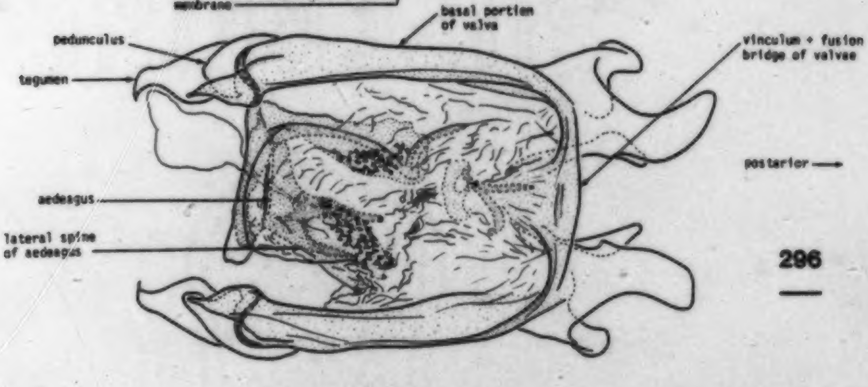
Figure 298. Tergum 8, dorsal aspect.


glanduliform sac
lobe of intersegmental membrane
tegumen
socii
lines of attachement of intersegmental membrane
valva
dentate plate of diaphragma
aedeagus
gnathos

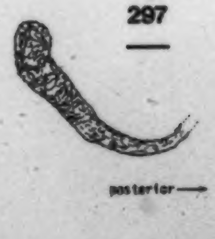
294


cucullar lobe
distal portion of valva
lateral spine of aedeagus
socius
phallotreme
aedeagus
bulbus ejac.
lobe of intersegmental membrane

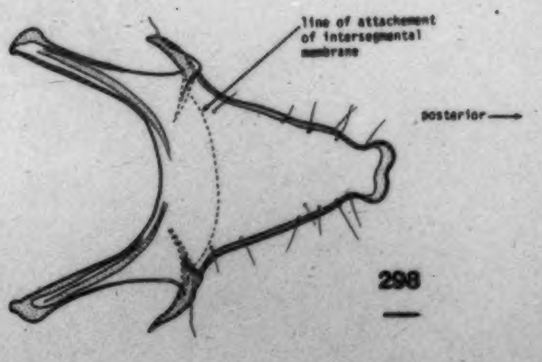
295


basal portion of valva
pedunculus
vinculum + fusion bridge of valvae
tegumen
posterior
aedeagus
lateral spine of aedeagus

296



297


line of attachement of intersegmental membrane
posterior

298

Figures 299 to 302. Structure of male genitalia and abdominal tergum 8 of *Serangites powelli*

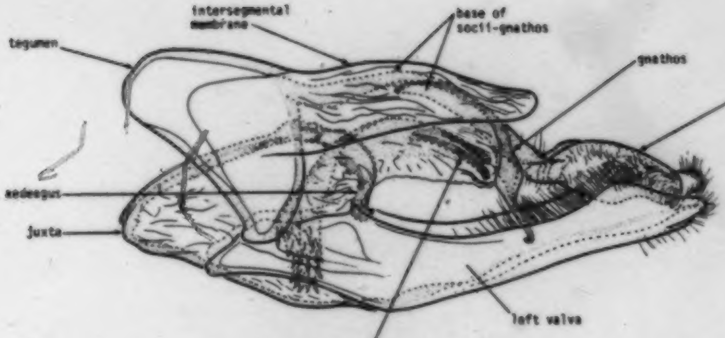
. Scale bars = 0.1 mm.

Figure 299. Genitalia, left lateral aspect.

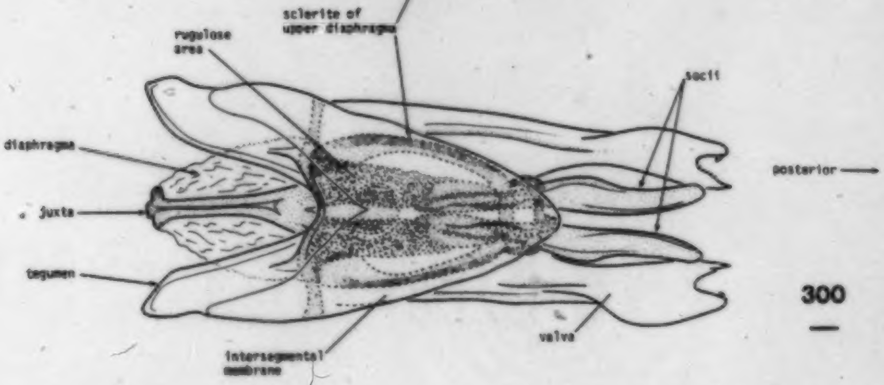
Figure 300. Genitalia, dorsal aspect.

Figure 301. Genitalia, ventral aspect.

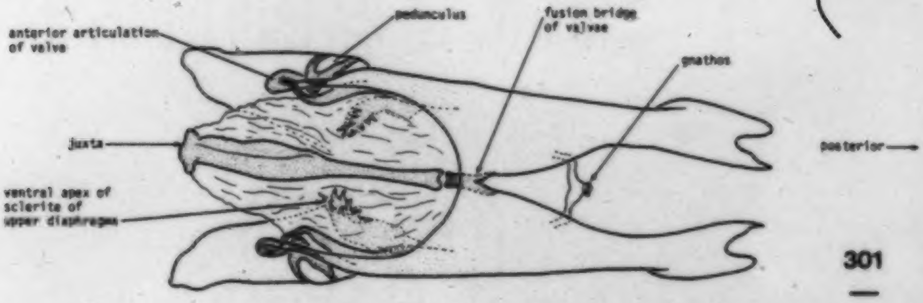
Figure 302. Tergum 8, dorsal aspect.


intersegmental membrane
base of socii-gnathos
tegumen
gnathos
socii
aedeagus
juxta
left valva

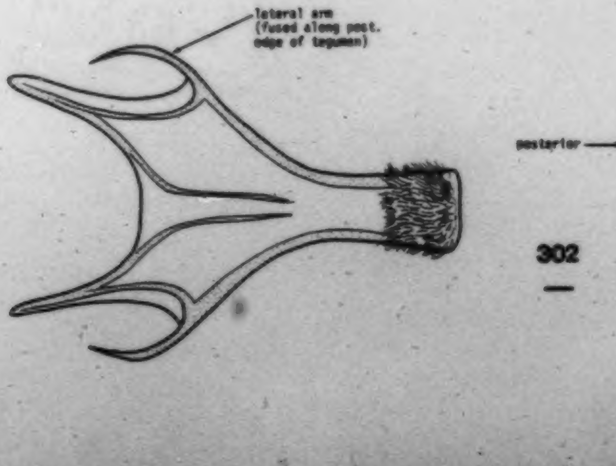
299


sclerite of upper diaphragma
rugulose area
socii
diaphragma
posterior →
juxta
tegumen
valva
intersegmental membrane

300

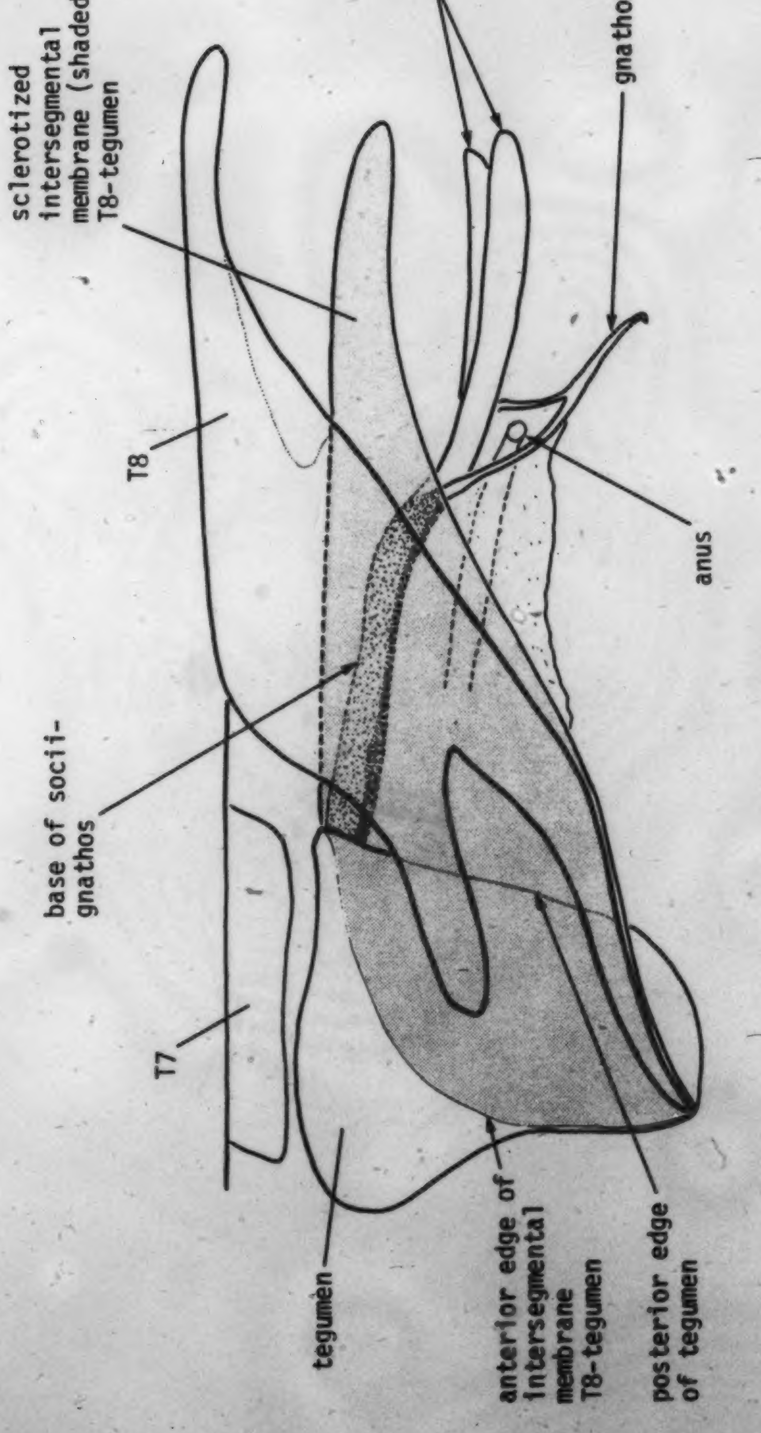

pedunculus
fusion bridge of valvae
anterior articulation of valva
gnathos
juxta
posterior →
ventral apex of sclerite of upper diaphragma

301


lateral arm (fused along post. edge of tegumen)
posterior →

302

Figure 303. Semi-diagrammatic lateral aspect of parts of male genitalia of imaginary scythridid of the *Arotrura* complex, illustrating structure of enlarged tergum 8, sclerotized and enlarged intersegmental membrane T8-tegumen and elongate socii, in relation to tegumen, gnathos and anus.


sclerotized intersegmental membrane (shaded) T8-tegumen
socii
gnathos
T8
anus
base of socii-gnathos
T7
tegumen
anterior edge of intersegmental membrane T8-tegumen
posterior edge of tegumen

303

Figures 304 to 305. Structure of female abdomen and external parts of genitalia of *Scythris limbella* . Scale bars = 0.1 mm.

Figure 304. Sternum 7, ventral aspect.

Figure 305. Sternum 8 and genitalia, ventral aspect.

Figures 306 to 309. Structure of female abdomen and external parts of genitalia of *Scythris mixaula* . Scale bars = 0.1 mm.

Figure 306. Tergum 7, dorsal aspect, antero-lateral arms spread out.

Figure 307. Segment 8, genitalia and ovipositor, ventral aspect.

Figure 308. Enlarged view of sternum 8.

Figure 309. Sternum 7, ventral aspect.

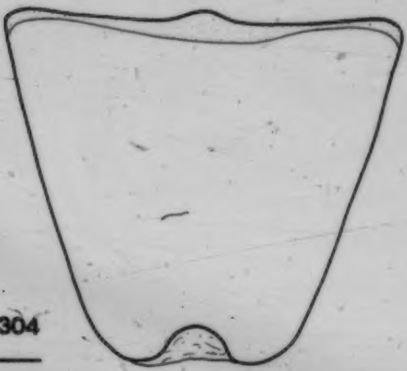
Posterior is toward bottom of page in all figures.

Abbreviations used in Figs. 305-371 are as follow:

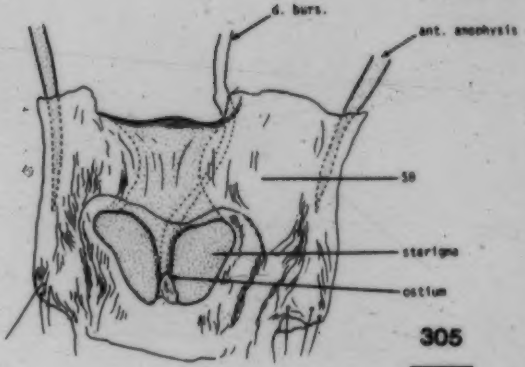
"ant." = anterior

"d. burs." = ductus bursae

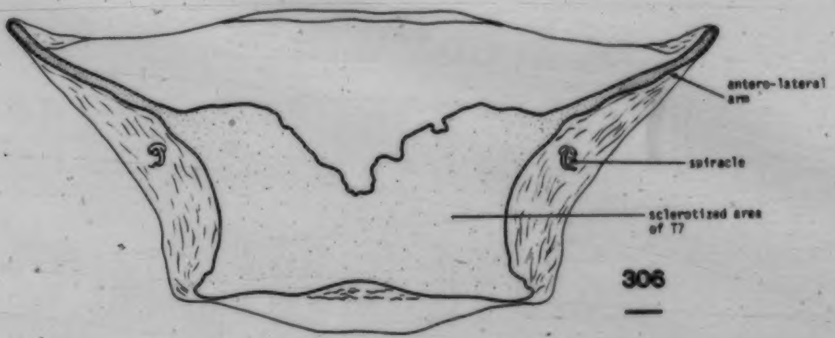
"post." = posterior



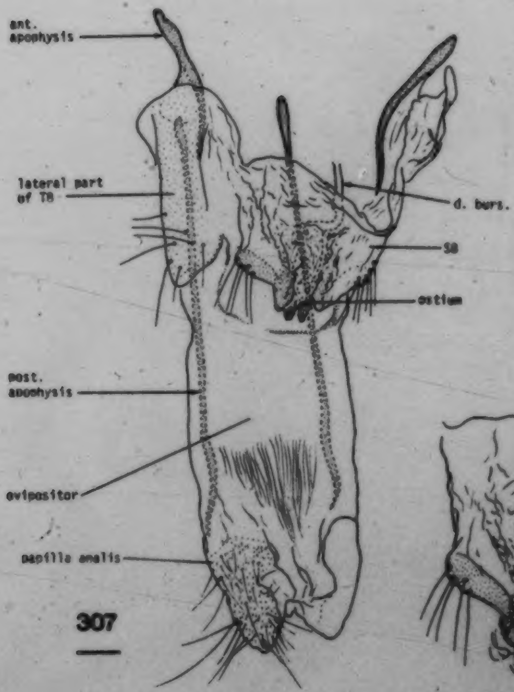
304


d. burs.
ant. apophysis
S8
sterigma
ostium

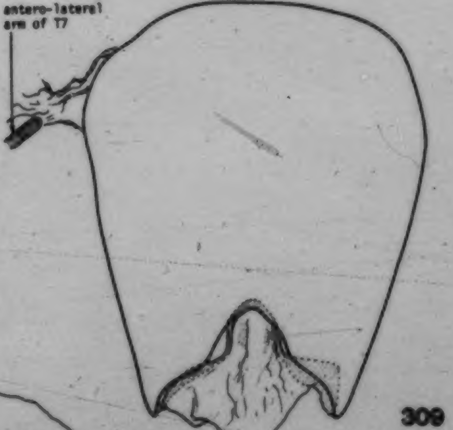
305


antero-lateral arm
spiracle
sclerotized area of T7

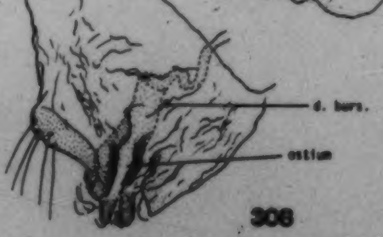
306


ant. apophysis
lateral part of T8
d. burs.
S8
ostium
post. apophysis
ovipositor
papilla analis

307


antero-lateral arm of T7

309


d. burs.
ostium

308

Figures 310 to 311. Structure of female abdomen and external parts of genitalia of *Scythris immaculatella* . Scale bars = 0.1 mm.

Figure 310. Sternum 7, ventral aspect.

Figure 311. Sternum 8 and genitalia, ventral aspect.

Figures 312 to 313. Structure of female abdomen and external parts of genitalia of *Scythris trivinctella* . Scale bars = 0.1 mm.

Figure 312. Sternum 7, ventral aspect.

Figure 313. Sternum 8 and genitalia, ventral aspect.

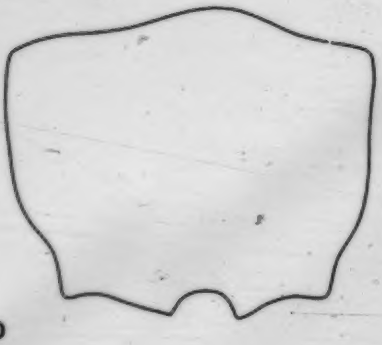
Figures 314 to 315. Structure of female abdomen and external parts of genitalia of *Scythris ypsilon* . Scale bars = 0.1 mm.

Figure 314. Tergum 7, dorsal aspect.

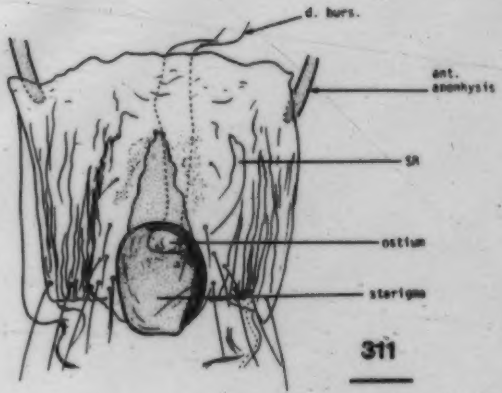
Figure 315. Sternum 8 and genitalia, ventral aspect.

Posterior is toward bottom of page in all figures.

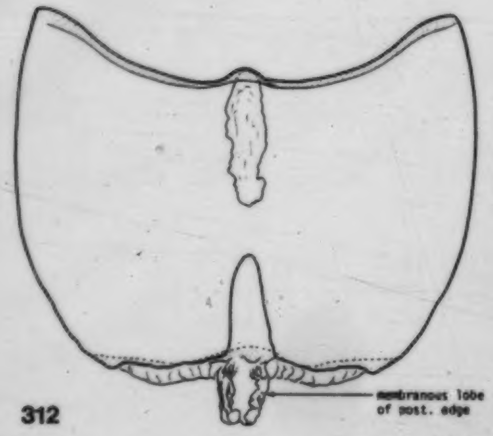
Abbreviations explained on p. 590.



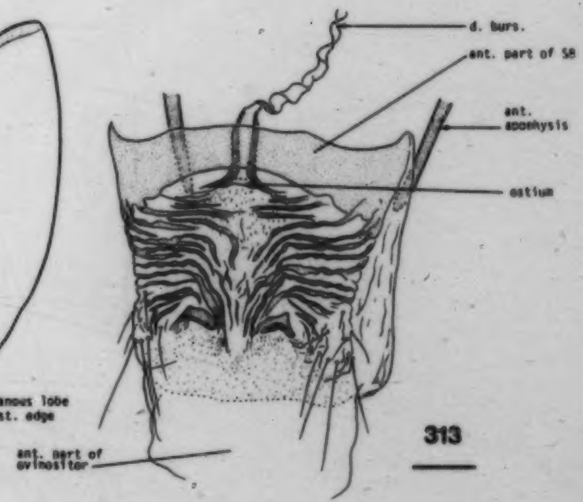
310


d. burs.
ant. apophysis
S8
ostium
sterigma

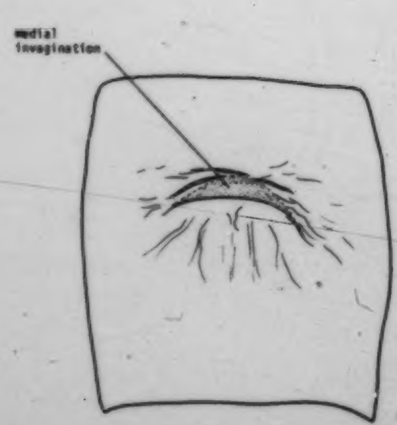
311


membranous lobe of post. edge

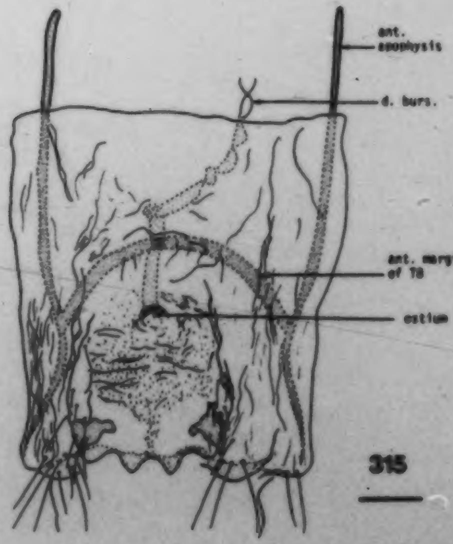
312


d. burs.
ant. part of S8
ant. apophysis
ostium
ant. part of ovipositor

313


medial invagination

314


ant. apophysis
d. burs.
ant. margin of T8
ostium

315

Figures 316 to 317. **Structure of female sternum 8 and external parts of genitalia of *Rhamphura*. Scale bars = 0.1 mm.**

Figure 316. ***Rhamphura ochristriata*.**

Figure 317. ***Rhamphura altisierrae*.**

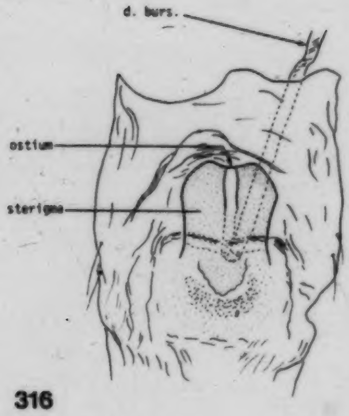
Figures 318 to 319. **Structure of female sterna 7 and 8 and external parts of genitalia of *Scythris* species. Scale bars = 0.1 mm.**

Figure 318. ***Scythris basilaris*.**

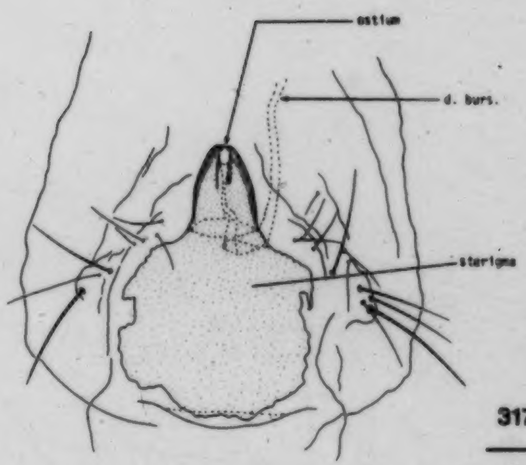
Figure 319. ***Scythris eboracensis*.**

Posterior is toward bottom of page in all figures.

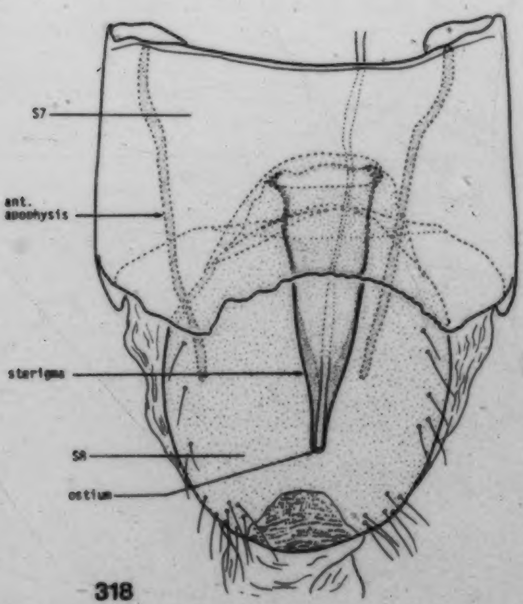
Abbreviations explained on p. 590.


d. burs.
ostium
sterigma

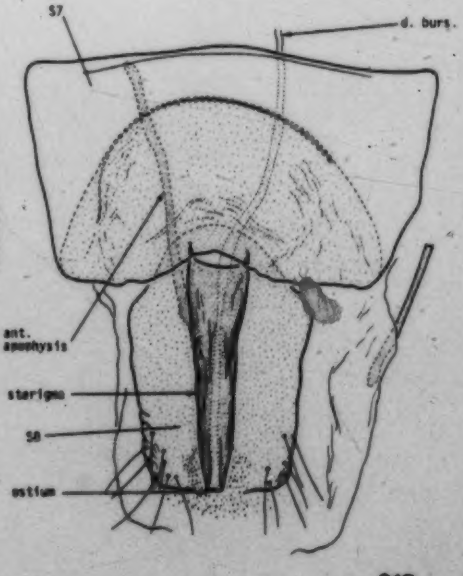
316


ostium
d. burs.
sterigma

317


S7
ant. apophysis
sterigma
S8
ostium

318


S7
d. burs.
ant. apophysis
sterigma
S8
ostium

319

Figures 320 to 321. Structure of female abdominal structure and external parts of genitalia of *Scythris interrupta* . Scale bars = 0.1 mm.

Figure 320. Sternum 7, ventral aspect.

Figure 321. Sternum 8 and genitalia, ventral aspect.

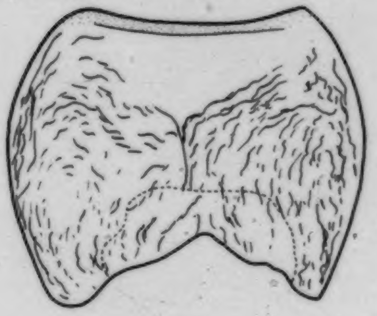
Figures 322 to 323. Structure of female sterna 7 and 8 and external parts of genitalia of *Scythris noricella* . Scale bars = 0.1 mm.

Figure 322. Sternum 7 and genitalia, ventral aspect.

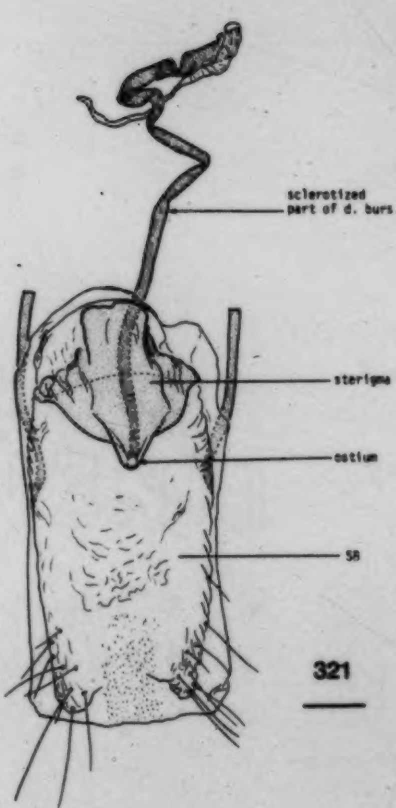
Figure 323. Segment 8, ventral aspect.

Posterior is toward bottom of page in all figures.

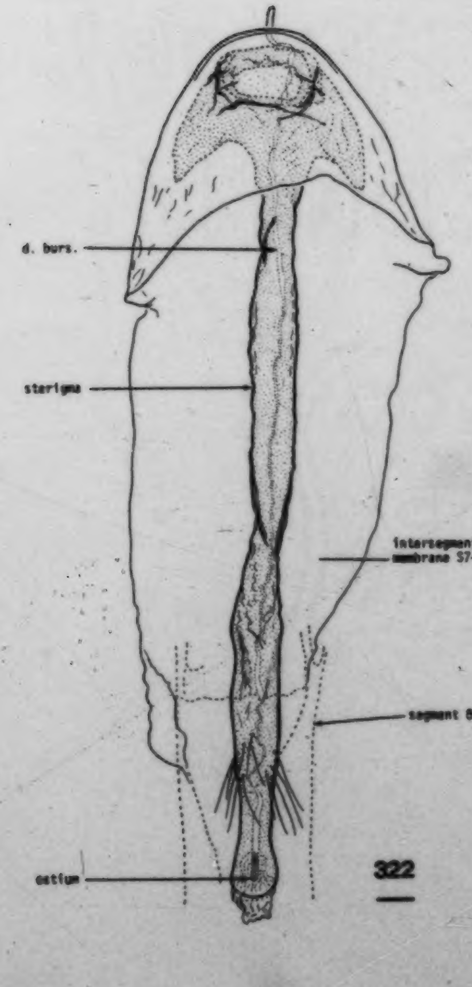
Abbreviations explained on p. 590.



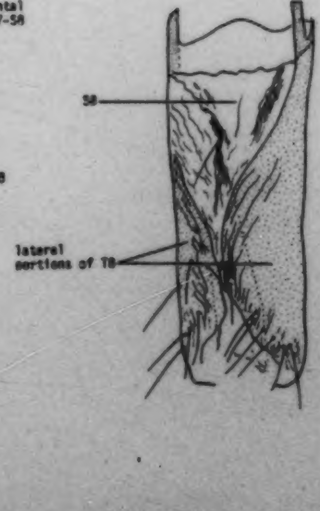
320


sclerotized
part of d. burs.
sterigma
ostium
S8

321


d. burs.
sterigma
intersegmental
membrane S7-S8
segment 8
ostium

322


S8
lateral
portions of T8

323

Figures 324 to 325. **Structure of external parts of female genitalia of *Scythris inspersella* .**

Scale bars = 0.1 mm.

Figure 324. **Sternum 7 and sterigma, ventral aspect.**

Figure 325. **Sterigma, left ventro-lateral aspect.**

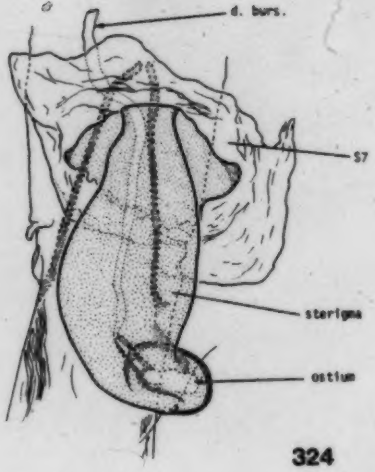
Figures 326 to 327. **Structure of female abdomen and external parts of genitalia of *Scythris anthracina* . Scale bars = 0.1 mm.**

Figure 326. **Sterna 7 and 8, genitalia and proximal portion of ovipositor, ventral aspect.**

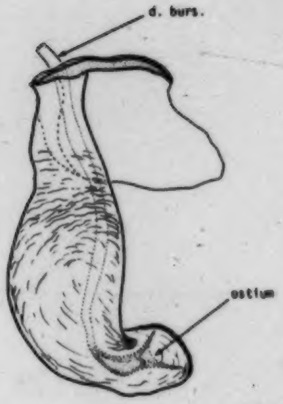
Figure 327. **Terga 3-7, inner aspect, showing invaginations filled with deciduous scales.**

Posterior is toward bottom of page in all figures.

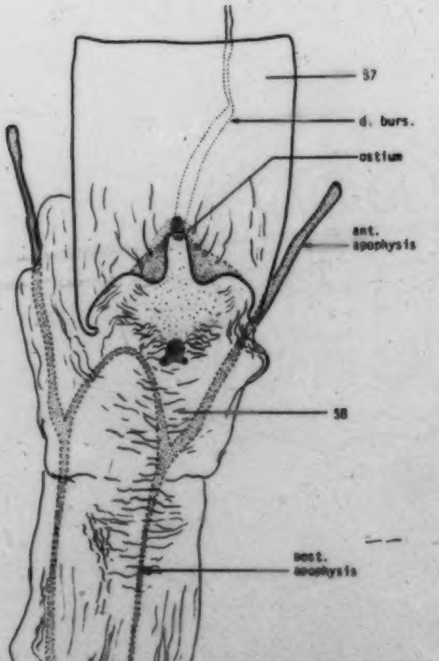
Abbreviations explained on p. 590.


d. burs.
S7
sterigma
ostium

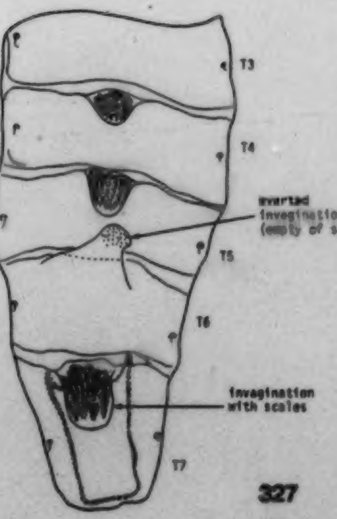
324


d. burs.
ostium

325


S7
d. burs.
ostium
ant. apophysis
S8
post. apophysis

326


T3
T4
everted invagination (empty of scales)
T5
T6
invagination with scales
T7

327

Figures 328 to 330. Structure of female abdomen and external parts of genitalia of *Scythris piratica* . Scale bars = 0.1 mm except Fig. 329 with scale bar = 0.05 mm.

Figure 328. Sternum 7, ventral aspect.

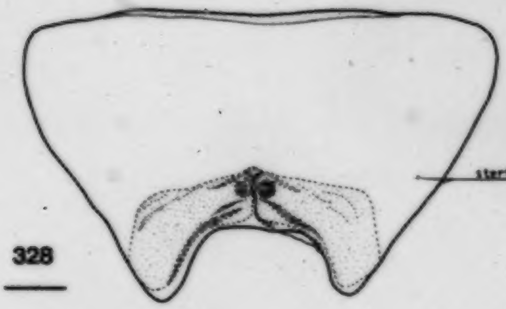
Figure 329. Enlarged view of inner aspect of median region of posterior emargination, showing details of paired, bulbous invaginations.

Figure 330. Sternum 8 and genitalia, ventral aspect.

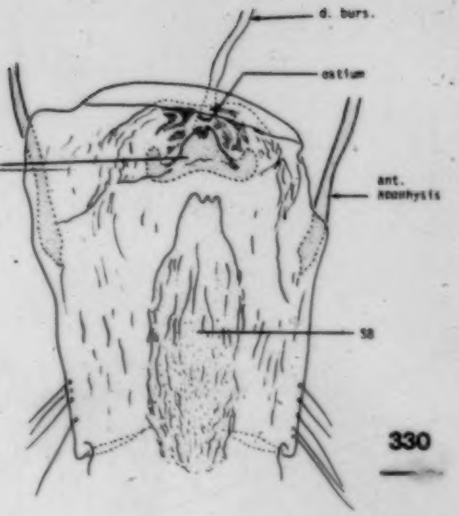
Figure 331. Structure of external parts of female genitalia and ovipositor of *Areniscythris brachypteris*, ventral aspect. Scale bar = 0.1 mm.

Posterior is toward bottom of page in all figures.

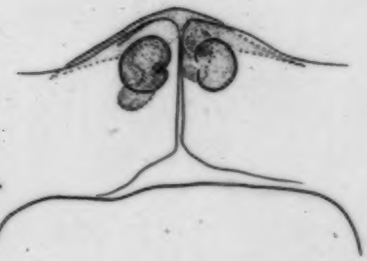
Abbreviations explained on p. 590.



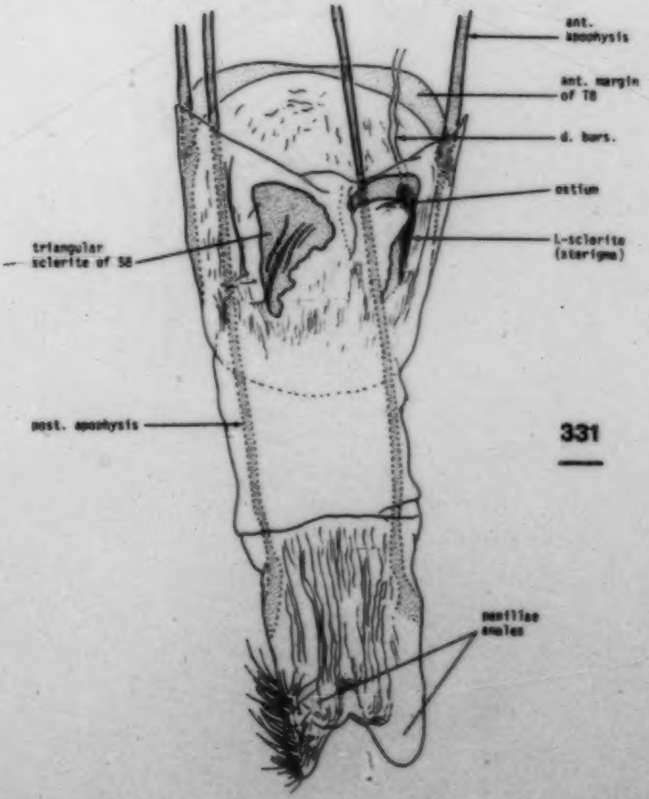
328


d. burs.
ostium
ant.
apophysis
S8

330



329


ant.
apophysis
ant. margin
of T8
d. burs.
ostium
triangular
sclerite of S8
L-sclerite
(sterigma)
post. apophysis
papillae
anales

331

Figures 332 to 333. **Structure of female abdomen and external parts of genitalia of *Asymmetrura graminivorella*. Scale bars = 0.1 mm.**

Figure 332. Sternum 7, ventral aspect.

Figure 333. Sternum 8 and genitalia, ventral aspect.

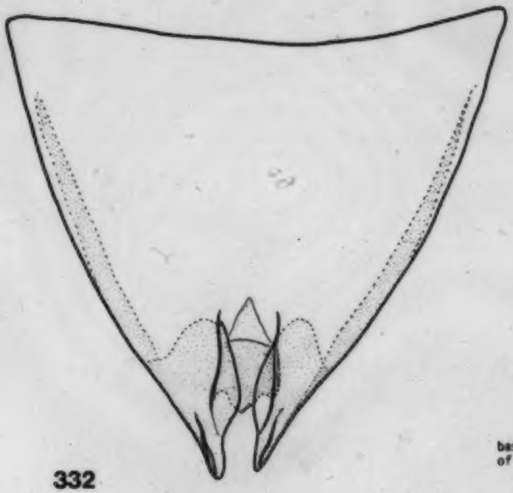
Figures 334 to 335. Structure of female abdomen and external parts of genitalia of *Asymmetrura reducta*. Scale bars = 0.1 mm.

Figure 334. Sternum 7, ventral aspect.

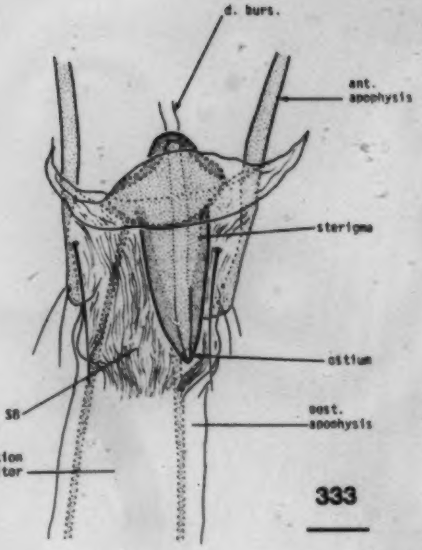
Figure 335. Sternum 8 and genitalia, ventral aspect.

Posterior is toward bottom of page in all figures.

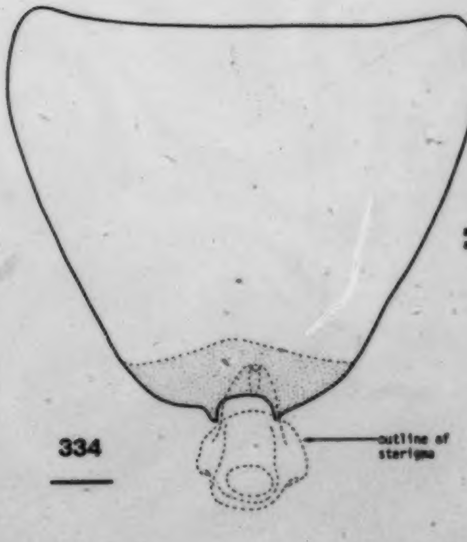
Abbreviations explained on p. 590.



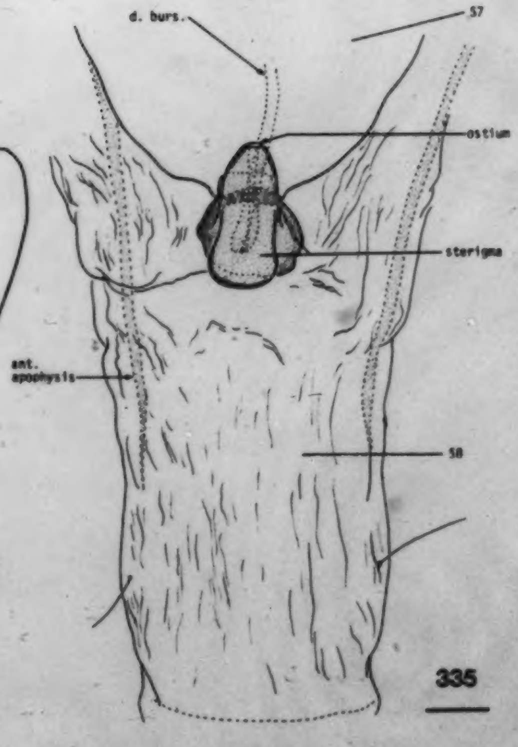
332


d. burs.
ant. apophysis
sterigma
ostium
S8
post. apophysis
basal portion of ovipositor

333


outline of sterigma

334


d. burs.
S7
ostium
sterigma
ant. apophysis
S8

335

Figures 336 to 337. **Structure of female abdomen and external parts of genitalia of *Asymmetrura matutella*. Scale bars = 0.1 mm.**

Figure 336. **Sternum 7, ventral aspect.**

Figure 337. **Sternum 8 and genitalia, ventral aspect.**

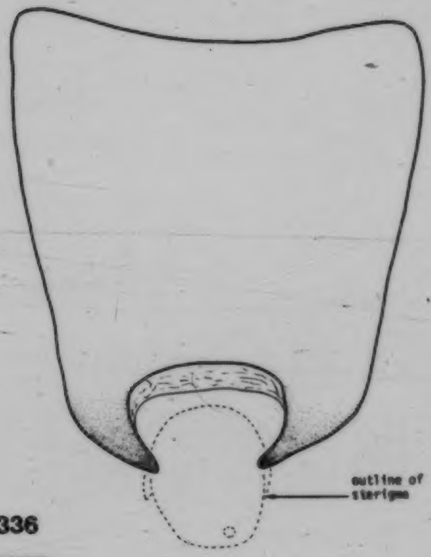
Figures 338 to 339. **Structure of female abdomen and external parts of genitalia of *Asymmetrura impositella*. Scale bars = 0.1 mm.**

Figure 338. **Sternum 7, ventral aspect.**

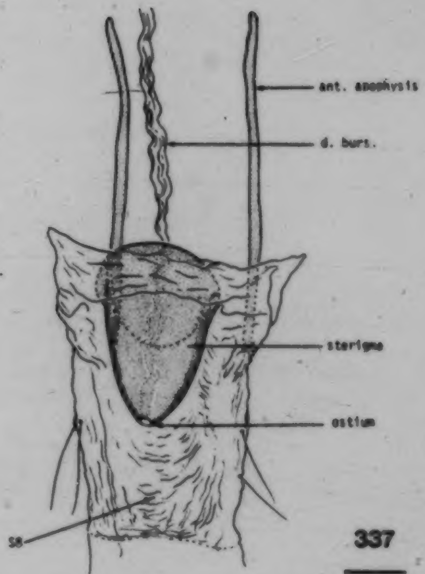
Figure 339. **Sternum 8 and genitalia, ventral aspect.**

Posterior is toward bottom of page in all figures.

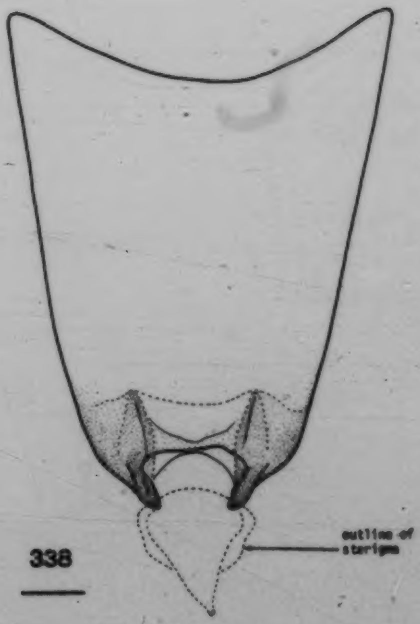
Abbreviations explained on p. 590.


outline of sterigma

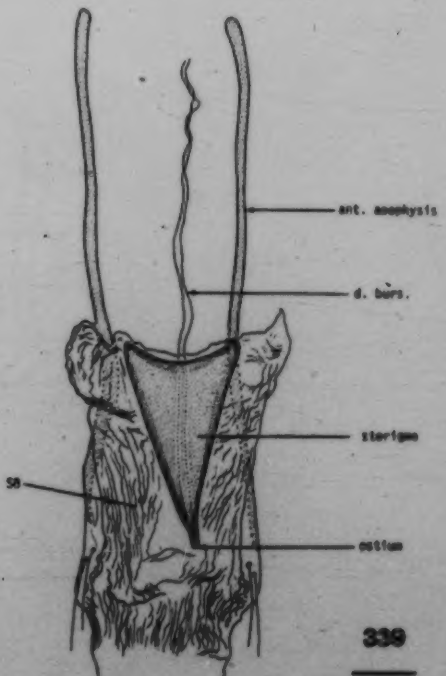
336


ant. apophysis
d. burs.
sterigma
ostium
S8

337


outline of sterigma

338


ant. apophysis
d. burs.
sterigma
S8
ostium

339

Figures 340 to 341. Structure of female abdomen and external parts of genitalia of *Neoscythris fissirostris* . Scale bars = 0.1 mm.

Figure 340. Sternum 7, ventral aspect.

Figure 341. Sternum 8 and genitalia, ventral aspect.

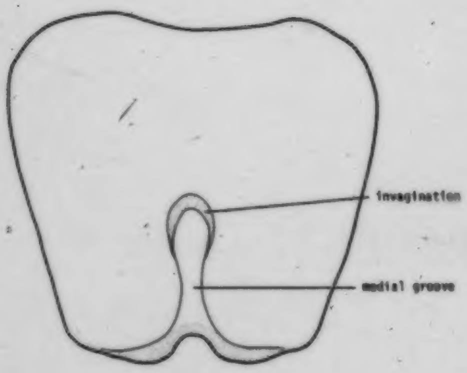
Figures 342 to 343. Structure of female abdomen and external parts of genitalia of *Neoscythris confinis* . Scale bars = 0.1 mm.

Figure 342. Sternum 7, ventral aspect.

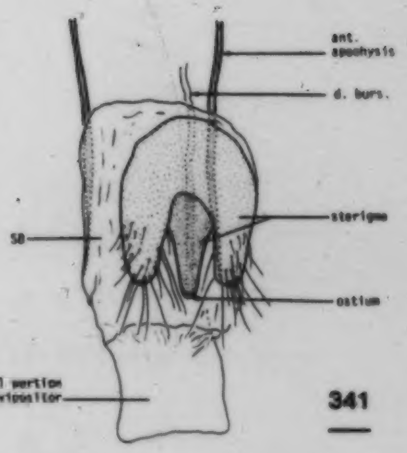
Figure 343. Sternum 8 and genitalia, ventral aspect.

Posterior is toward bottom of page in all figures.

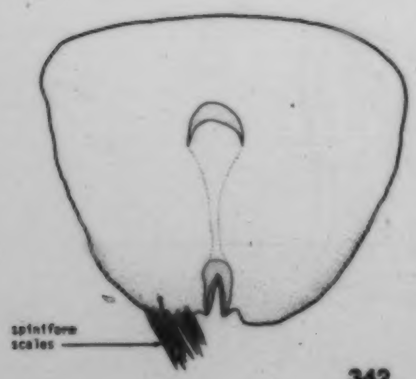
Abbreviations explained on p. 590.


invagination
medial groove

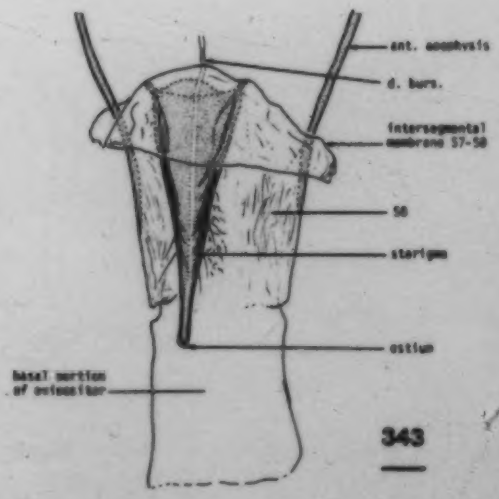
340


ant. apophysis
d. burs.
sterigma
S8
ostium
basal portion of ovipositor

341


spiniform scales

342


ant. apophysis
d. burs.
intersegmental membrane S7-S8
S8
sterigma
ostium
basal portion of ovipositor

343

Figures 344 to 346. Structure of female abdomen and external parts of genitalia of *Colinita sponsella* . Scale bars = 0.1 mm.

Figure 344. Segment 6, right lateral aspect.

Figure 345. Sterna 7-8 and genitalia, ventral aspect.

Figure 346. Sterna 7-8 and genitalia, left lateral aspect.

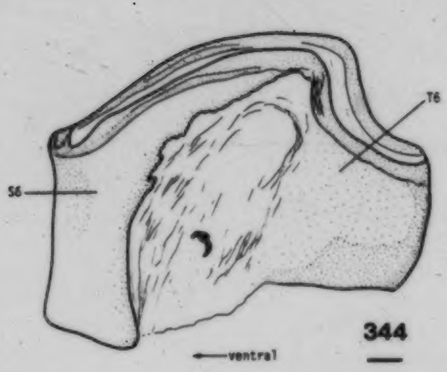
Figures 347 to 348. Structure of female abdomen and external parts of genitalia of *Hyalinixys sinuosa* . Scale bars = 0.1 mm.

Figure 347. Sterna 6-8 and genitalia, ventral aspect.

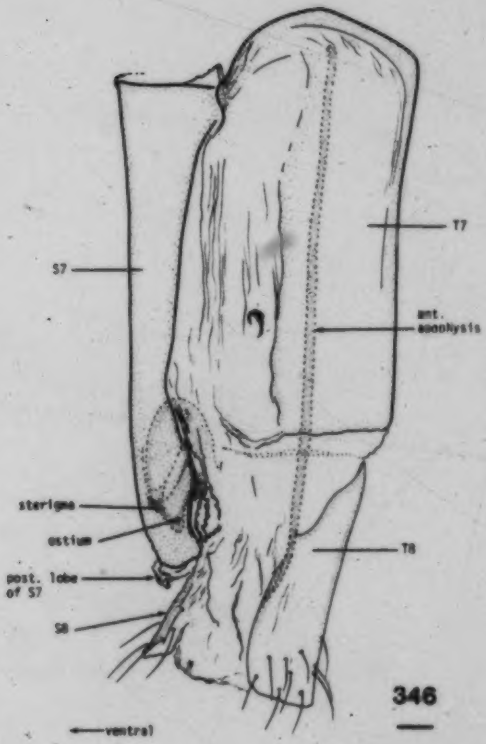
Figure 348. Sterna 6-8 and genitalia, left lateral aspect, ventral side up.

Posterior is toward bottom of page in most figures except Fig. 348, in which posterior is toward left of the page.

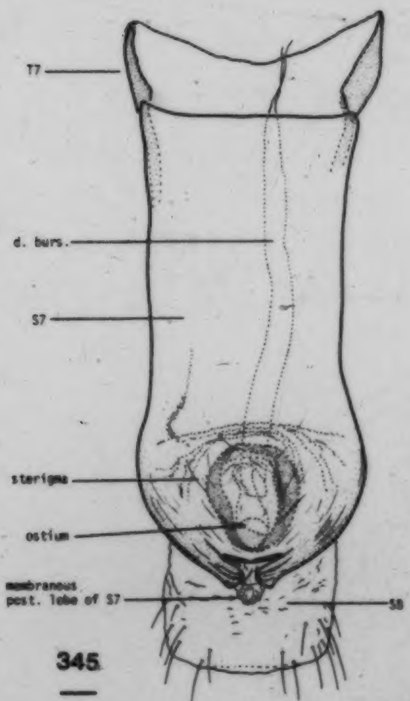
Abbreviations explained on p. 590.


T6
S6
←ventral

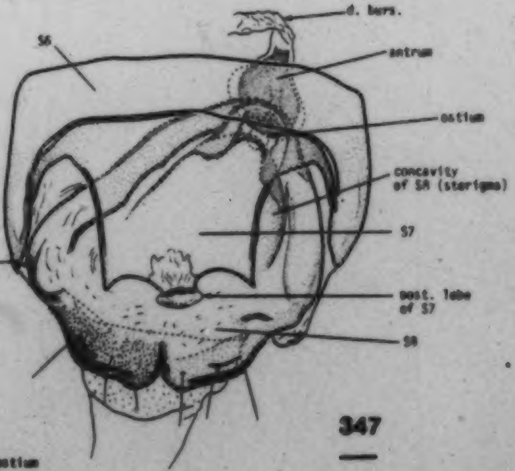
344


S7
T7
ant. apophysis
sterigma
ostium
post. lobe of S7
S8
T8
←ventral

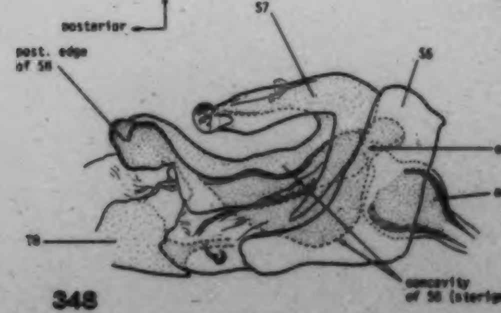
346


T7
d. burs.
S7
sterigma
ostium
membranous post. lobe of S7
S8

345


d. burs.
S6
antrum
ostium
concavity of S8 (sterigma)
S7
post. lobe of S7
S8

347


ventral
posterior
S7
S6
post. edge of S8
ostium
antrum
T8
concavity of S8 (sterigma)

348

Figures 349 to 350. Structure of female abdomen of *Hyalinixys sinuosa* .

Scale bars = 0.1 mm.

Figure 349. Terga 5-7, dorsal aspect.

Figure 350. Sternum 7, ventral aspect.

Figures 351 to 352. Structure of female abdomen and external parts of genitalia of *Meniscotus balli* . Scale bars = 0.1 mm.

Figure 351. Tergum 7, dorsal aspect.

Figure 352. Sternum 8 and genitalia, ventral aspect.

Figure 353. Structure of female abdomen and genitalia of *Mimiella divaricata* , ventral aspect. Scale bar = 0.1 mm.

Figures 354 to 358. Structure of female abdomen and external parts of genitalia of *Aeciatus formidabilis* . Scale bars = 0.1 mm.

Figure 354. Sternum 8 and genitalia, ventral aspect.

Figure 355. Sternum 8 and genitalia, left lateral aspect (ventral side up).

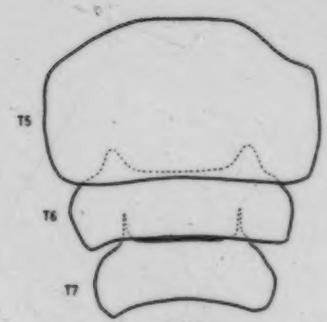
Figure 356. Semi-diagrammatic representation of structure shown in Fig. 355.

Figure 357. Papillae anales, dorsal aspect (setae omitted).

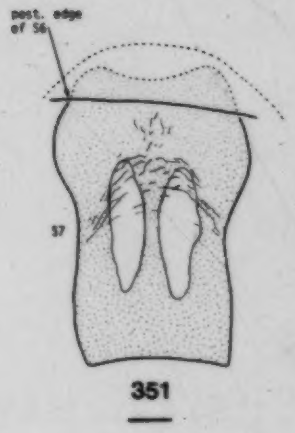
Figure 358. Papillae anales, lateral aspect (some setae omitted).

Posterior is toward bottom of page in most figures except Figs. 355-356, in which posterior is toward left of the page.

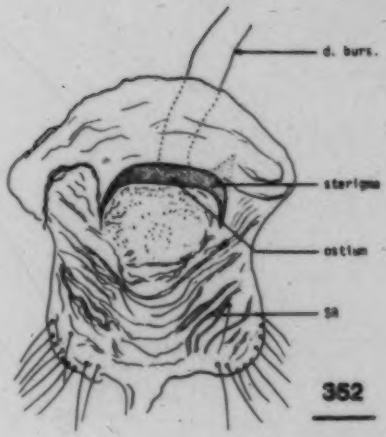
Abbreviations explained on p. 590.



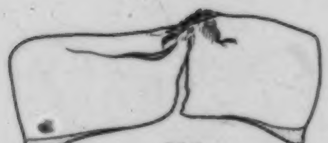
349


post. edge of S6
S7

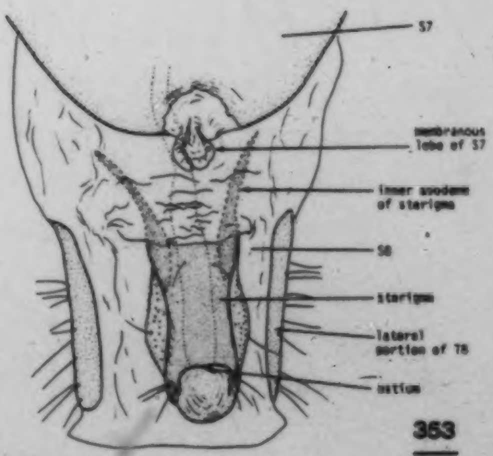
351


d. burs.
sterigma
ostium
S8

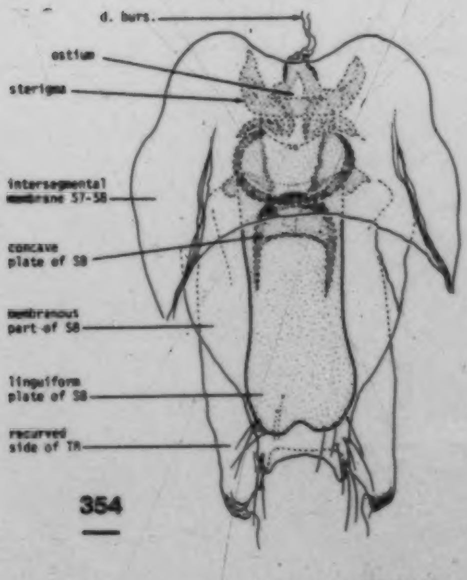
352



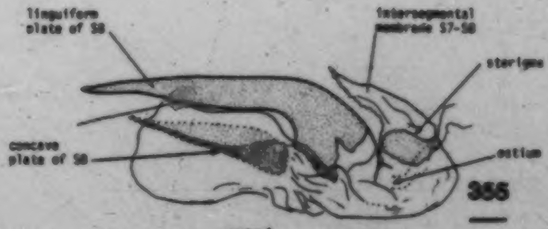
350


S7
membranous lobe of S7
inner apodeme of sterigma
S8
sterigma
lateral portion of T8
ostium

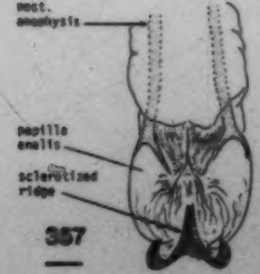
353


d. burs.
ostium
sterigma
intersegmental membrane S7-S8
concave plate of S8
membranous part of S8
linguiform plate of S8
recurved side of T8

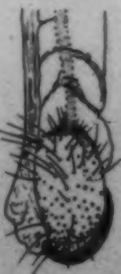
354


linguiform plate of S8
intersegmental membrane S7-S8
sterigma
concave plate of S8
ostium

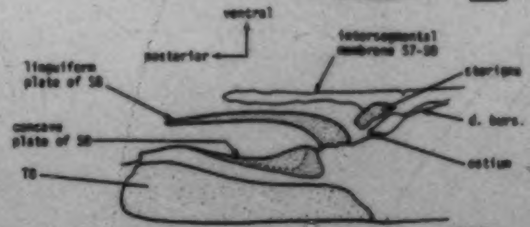
355


post. apophysis
papilla analis
sclerotized ridge

357



358


ventral
posterior
intersegmental membrane S7-S8
sterigma
linguiform plate of S8
d. burs.
concave plate of S8
ostium
T8

356

Figures 359 to 361. Structure of female abdomen and parts of genitalia of *Oncoxystus longissimus* . Scale bars = 0.1 mm.

Figure 359. Sternum 7, ventral aspect.

Figure 360. Sternum 8 and genitalia, ventral aspect.

Figure 361. Medial portion of vestibulum of vagina, showing fine convolutions of membranous wall.

Figures 362 to 364. Structure of female abdomen and external parts of genitalia of *Arotrura eburnea* . Scale bars = 0.1 mm.

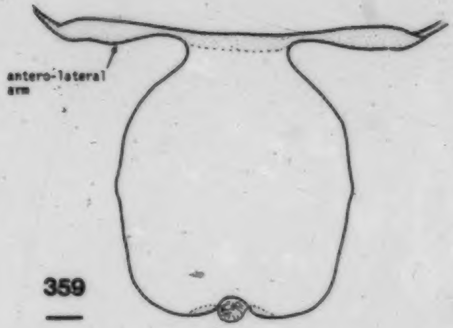
Figure 362. Sternum 7, ventral aspect.

Figure 363. Tergum 7, dorsal aspect.

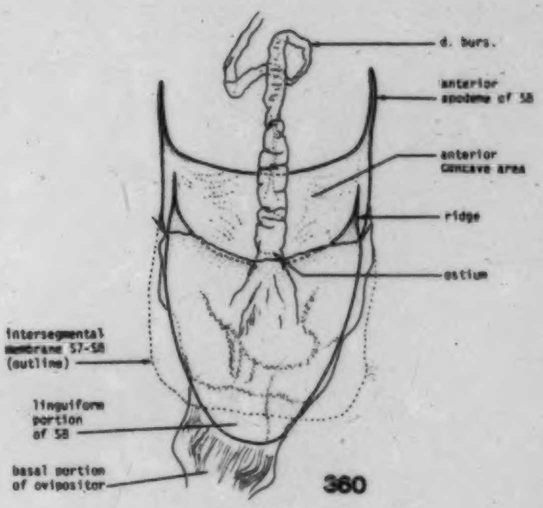
Figure 364. Sternum 8 and genitalia, ventral aspect.

Posterior is toward bottom of page in all figures.

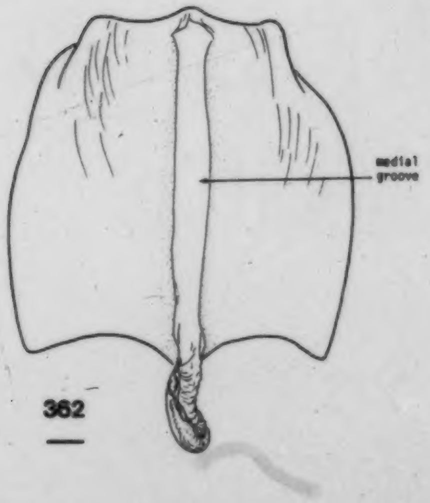
Abbreviations explained on p. 590.


antero-lateral arm

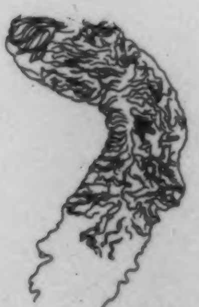
359


d. burs.
anterior apodeme of S8
anterior Concave area
ridge
ostium
intersegmental membrane S7-S8 (outline)
linguiform portion of S8
basal portion of ovipositor

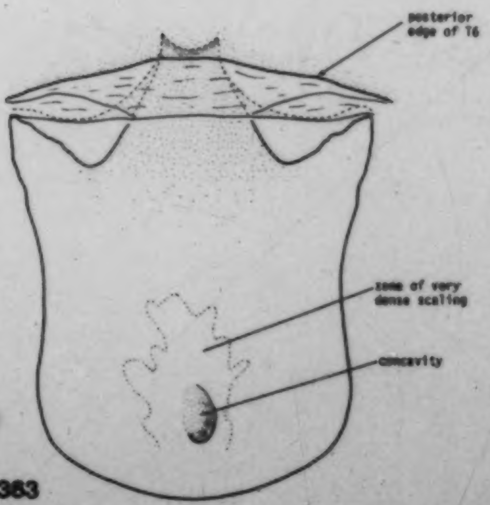
360


medial groove

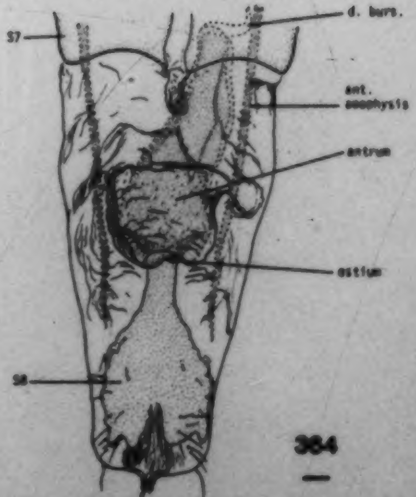
362



361


posterior edge of T6
zone of very dense scaling
concavity

363


d. burs.
S7
ant. apophysis
antrum
ostium
S8

364

Figures 365 to 367. Structure of female abdomen and external parts of genitalia of *Commodes radulatus* . Scale bars = 0.1 mm.

Figure 365. Sternum 7, ventral aspect.

Figure 366. Sternum 8 and genitalia, ventral aspect.

Figure 367. Semi-diagrammatic representation of sternum 8 and genitalia, lateral aspect.

Figures 368 to 371. Structure of female abdomen and external parts of genitalia of *Serangites powelli* . Scale bars = 0.1 mm.

Figure 368. Terga 6-7, dorsal aspect.

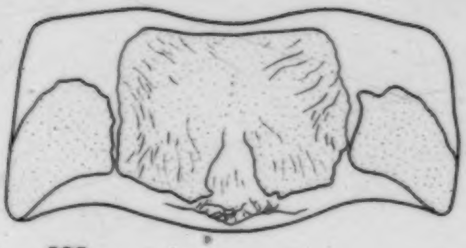
Figure 369. Sterna 6-7, ventral aspect.

Figure 370. Enlarged view of sternum 6, ventral aspect, showing sclerotized invagination of anterior margin.

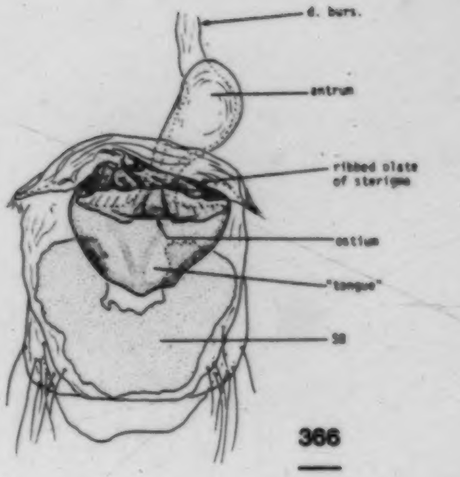
Figure 371. Sternum 8 and genitalia, ventral aspect.

Posterior is toward bottom of page in most figures except Fig. 367, in which posterior is toward right of the page.

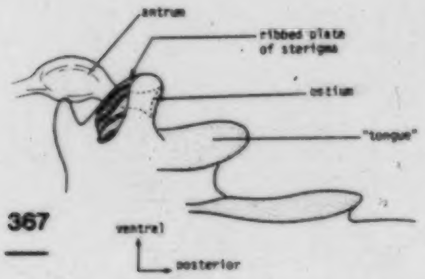
Abbreviations explained on p. 590.



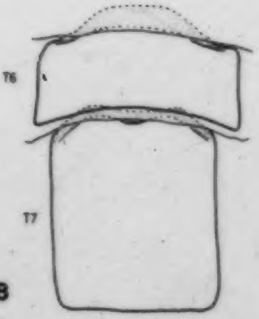
365


d. burs.
antrum
ribbed plate of sterigma
ostium
"tongue"
S8

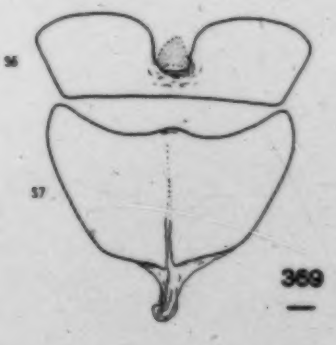
366


antrum
ribbed plate of sterigma
ostium
"tongue"
ventral
posterior

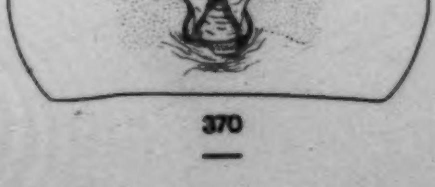
367



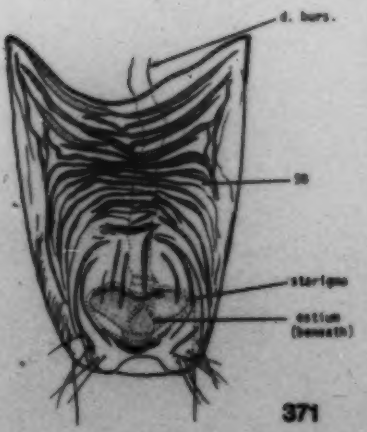
368



369



370


d. burs.
S8
sterigma
ostium (beneath)

371

Figures 372 to 378. Structure of internal parts of female genitalia of scythridids, illustrating bursa, ducts and glands (ventral aspect, unless otherwise indicated). Scale bars = 0.2 mm.

Figure 372. *Scythris limbella* .

Figure 373. *Scythris immaculatella* .

Figure 374. *Scythris mixaula* .

Figure 375. *Scythris trivinctella* .

Figure 376. *Scythris ypsilon* .

Figure 377. *Rhamphura ochristriata* .

Figure 378. *Rhamphura altisierrae* , bursa rotated in left lateral aspect.

Posterior is toward bottom of page in all figures.

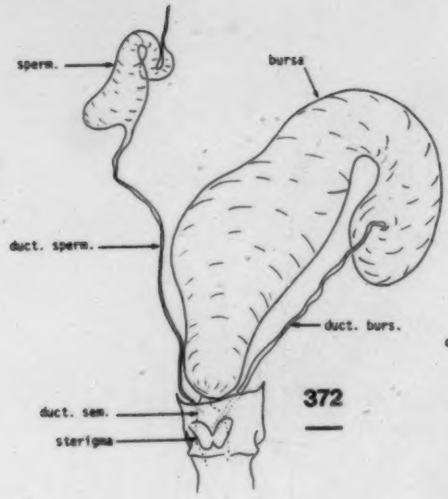
Abbreviations used in Figs. 372-400 are as follow:

"duct. burs." = ductus bursae

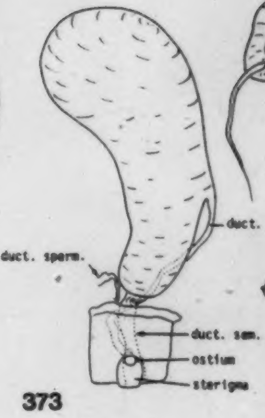
"duct. sem." = ductus seminalis

"duct. sperm." = ductus spermathecae

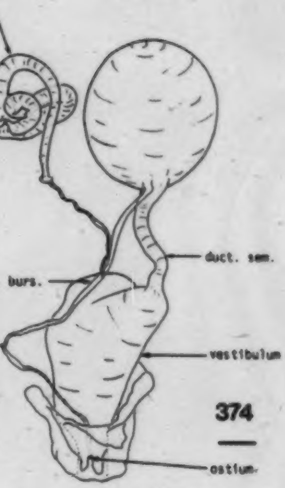
"sperm." = spermatheca.


sperm.
bursa
duct. sperm.
duct. burs.
duct. sem.
sterigma

372

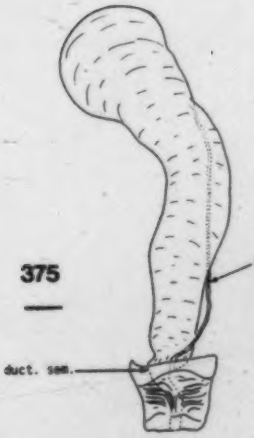

duct. sperm.
duct. sem.
ostium
sterigma

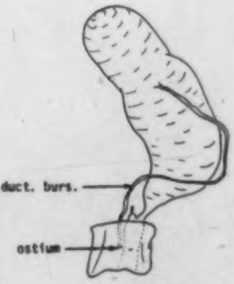
373


sperm.
duct. burs.
duct. sem.
vestibulum
ostium

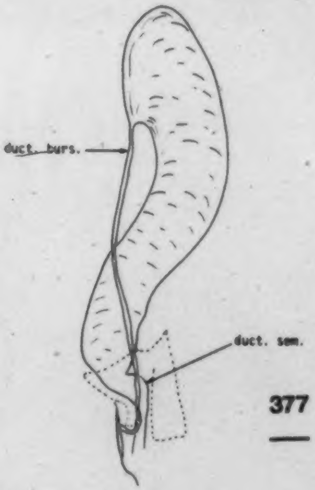
374

375

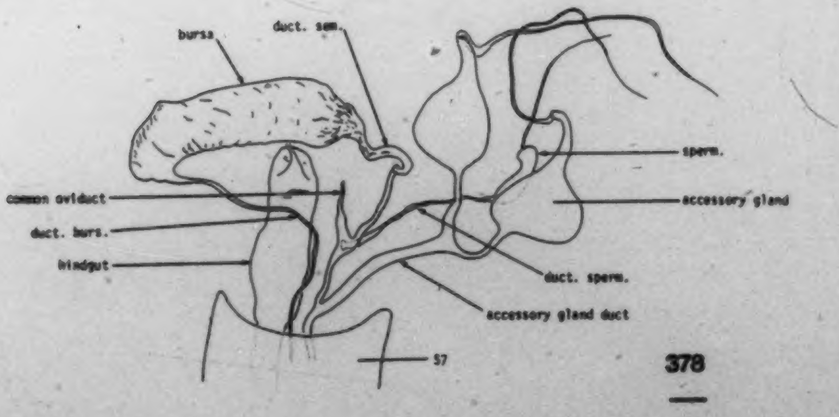

duct. burs.
duct. sem.



376


duct. burs.
duct. sem.

377


bursa
duct. sem.
sperm.
common oviduct
accessory gland
duct. burs.
hindgut
duct. sperm.
accessory gland duct
57

378

Figures 379 to 385. Structure of internal parts of female genitalia of scythridids, illustrating bursa, ducts and glands (ventral aspect, unless otherwise indicated). Scale bars = 0.2 mm.

Figure 379. *Scythris basilaris* .

Figure 380. *Scythris eboracensis* .

Figure 381. *Scythris interrupta* .

Figure 382. *Scythris inspersella* , left lateral aspect.

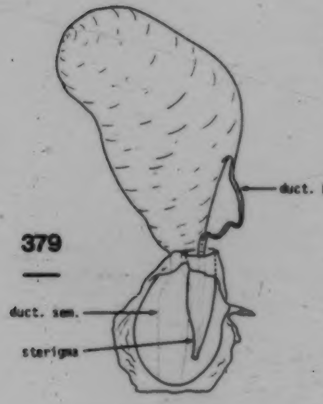
Figure 383. *Scythris noricella* , left lateral aspect; the large arrow near the ductus spermathecae indicates the corresponding point on Fig. 384.

Figure 384. *Scythris noricella* , spermatheca and ductus spermathecae; the large arrow indicates the corresponding point on Fig. 383.

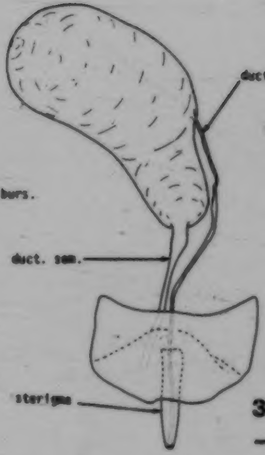
Figure 385. *Scythris anthracina* , left lateral aspect.

Posterior is toward bottom of page in all figures.

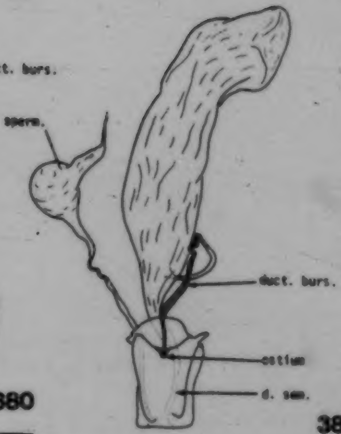
Abbreviations explained on p. 616.


duct. burs.
duct. sem.
sterigma

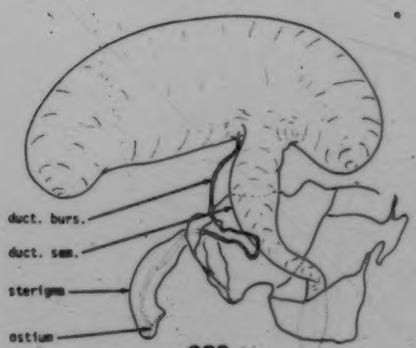
379


duct. burs.
duct. sem.
sterigma

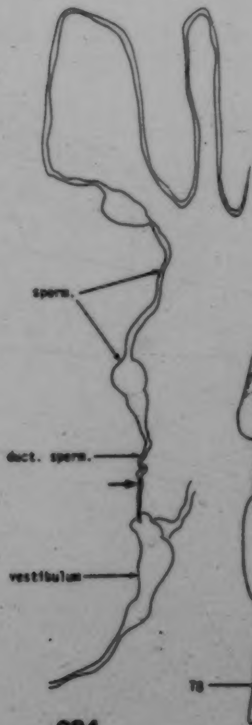
380


sperm.
duct. burs.
ostium
d. sem.

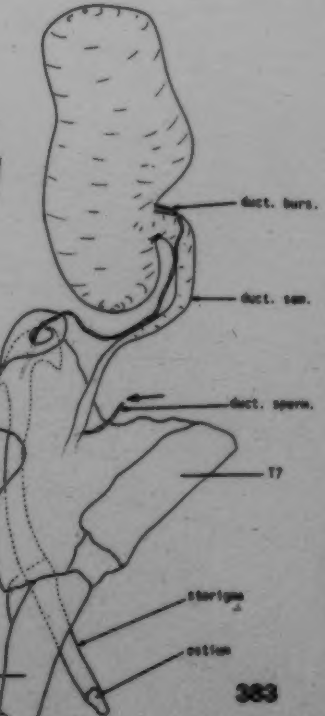
381


duct. burs.
duct. sem.
sterigma
ostium

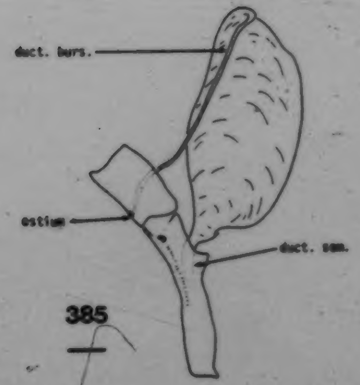
382


sperm.
duct. sperm.
vestibulum

384


duct. burs.
duct. sem.
duct. sperm.
T7
sterigma
ostium
T8

383


duct. burs.
ostium
duct. sem.

385

Figures 386 to 392. Structure of internal parts of female genitalia of scythridids, illustrating bursa, ducts and glands (ventral aspect, unless otherwise indicated). Scale bars = 0.2 mm.

Figure 386. *Areniscythris brachypteris* .

Figure 387. *Asymmetrura graminivorella* .

Figure 388. *Asymmetrura matutella* .

Figure 389. *Asymmetrura impositella* , right lateral aspect.

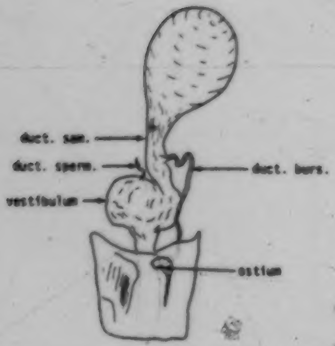
Figure 390. *Asymmetrura reducta* , posterior end of bursa rotated anteriorly in direction of arrow.

Figure 391. *Neoscythris fissirostris* .

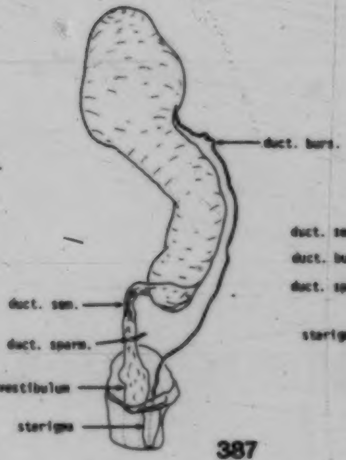
Figure 392. *Neoscythris confinis* .

Posterior is toward bottom of page in all figures.

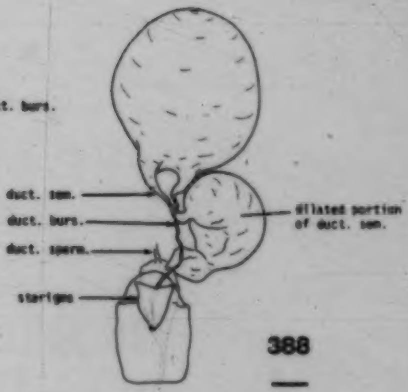
Abbreviations explained on p. 616.


duct. sem.
duct. sperm.
duct. burs.
vestibulum
ostium

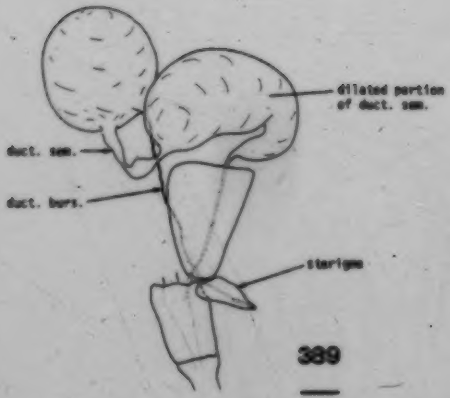
386


duct. burs.
duct. sem.
duct. sperm.
vestibulum
sterigma

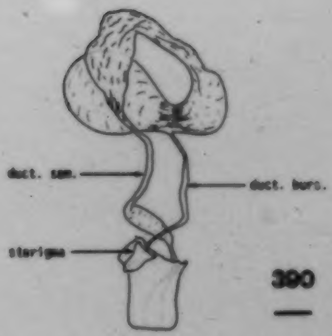
387


duct. sem.
duct. burs.
duct. sperm.
dilated portion
of duct. sem.
sterigma

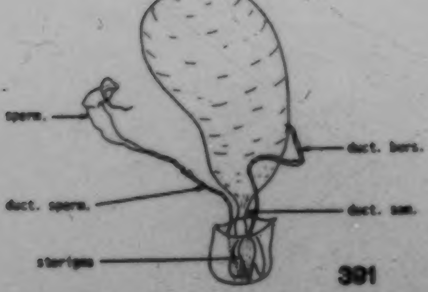
388


dilated portion
of duct. sem.
duct. sem.
duct. burs.
sterigma

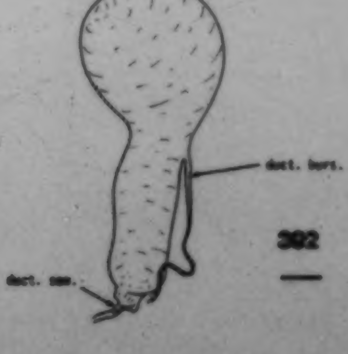
389


duct. sem.
duct. burs.
sterigma

390


sperm.
duct. burs.
duct. sperm.
duct. sem.
sterigma

391


duct. burs.
duct. sem.

392

Figures 393 to 400. Structure of internal parts of female genitalia of scythridids, illustrating bursa, ducts and glands (ventral aspect, unless otherwise indicated). Scale bars = 0.2 mm.

Figure 393. *Colinita sponsella* .

Figure 394. *Hyalinixys sinuosa* .

Figure 395. *Meniscotus balli* .

Figure 396. *Mimiella divaricata* , right lateral aspect.

Figure 397. *Oncoxystus longissimus* , right lateral aspect.

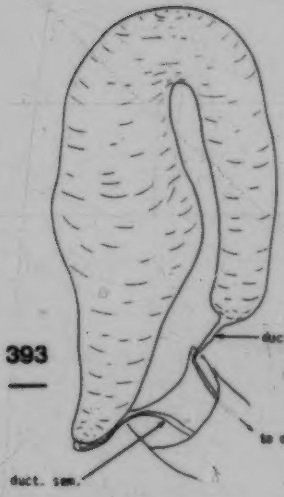
Figure 398. *Commodes radulatus* .

Figure 399. *Arotrura eburnea* .

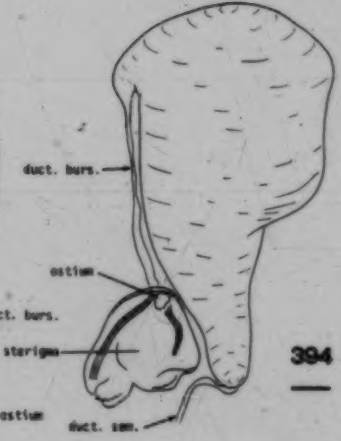
Figure 400. *Serangites powelli* .

Posterior is toward bottom of page in all figures.

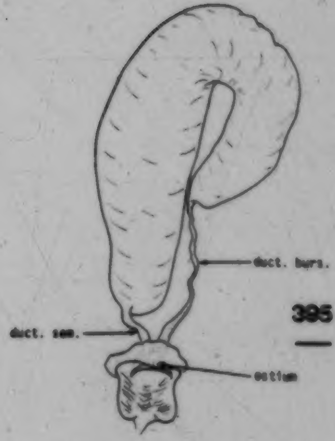
Abbreviations explained on p. 616.


duct. burs.
to ostium
duct. sem.

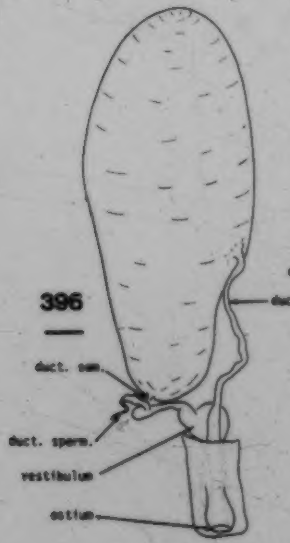
393


duct. burs.
ostium
sterigma
duct. sem.

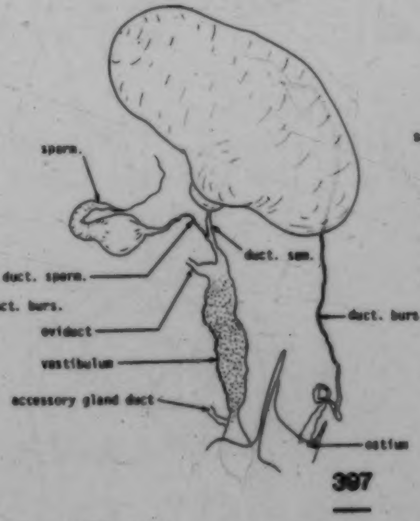
394


duct. burs.
duct. sem.
ostium

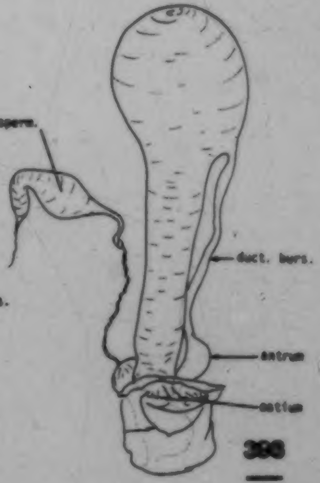
395


duct. burs.
duct. sem.
duct. sperm.
vestibulum
ostium

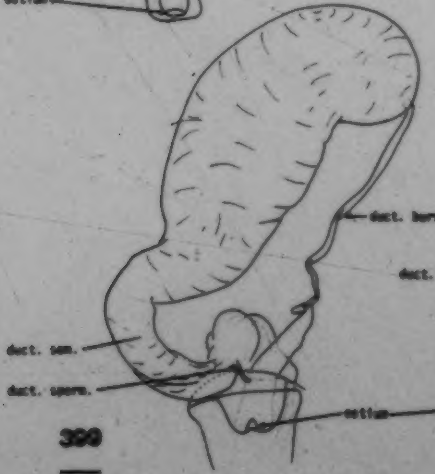
396


sperm.
duct. sperm.
duct. sem.
oviduct
vestibulum
accessory gland duct
duct. burs.
ostium

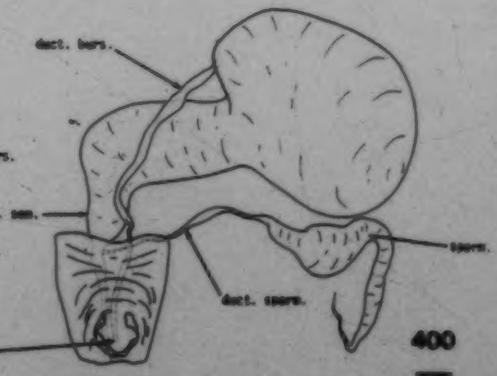
397


sperm.
duct. burs.
antrum
ostium

398


duct. burs.
duct. sem.
duct. sperm.
ostium

399

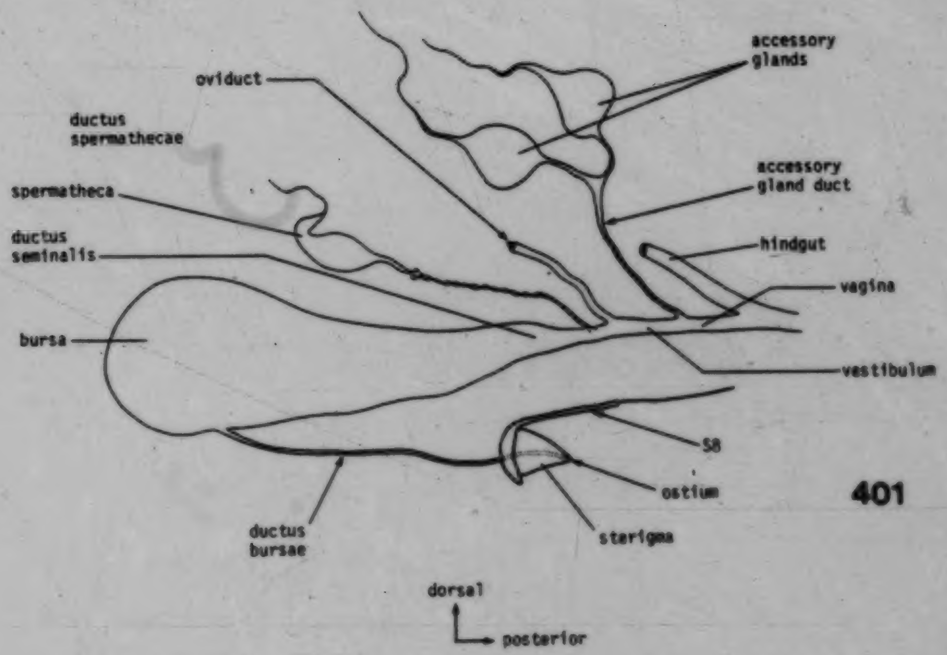

duct. burs.
duct. sem.
sperm.
duct. sperm.

400

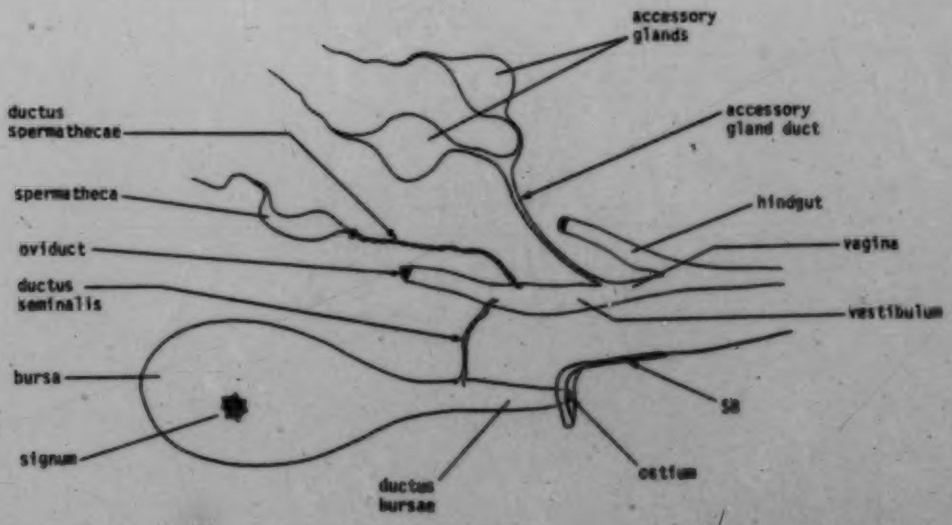
Figures 401 to 402. Comparison of internal parts of female genitalia of imaginary scythridid and non-scythridid gelechioid (semi-diagrammatic representation in left lateral aspect), illustrating differences in relation among ductus bursae, corpus bursae, and ductus seminalis.

Figure 401. Scythridid.

Figure 402. Non-scythridid gelechioid.


accessory glands
oviduct
ductus spermathecae
accessory gland duct
spermatheca
hindgut
ductus seminalis
vagina
bursa
vestibulum
SB
ostium
ductus bursae
sterigma
dorsal
posterior

401

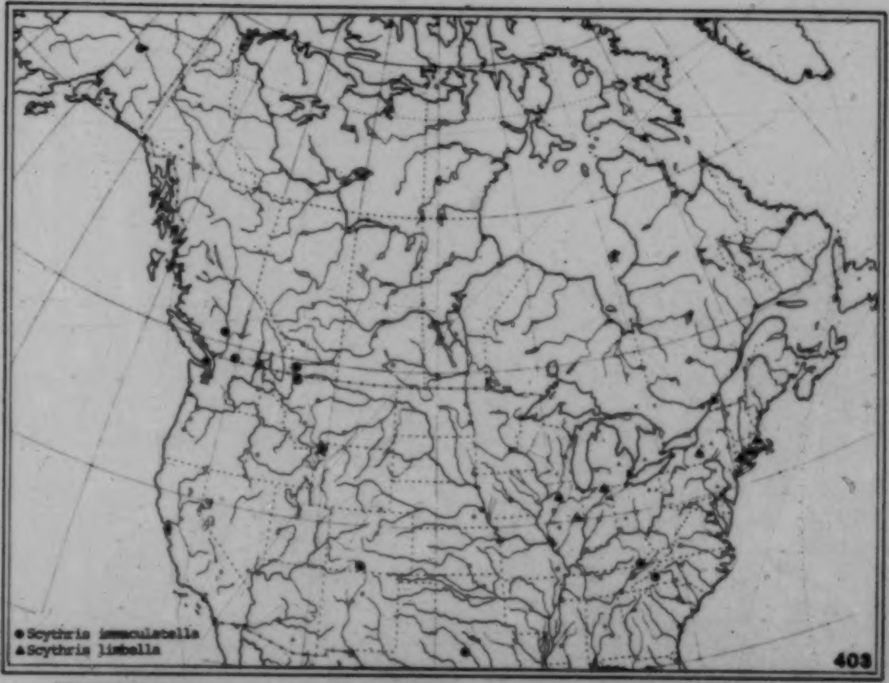

accessory glands
ductus spermathecae
accessory gland duct
spermatheca
hindgut
oviduct
vagina
ductus seminalis
vestibulum
bursa
SB
signum
ostium
ductus bursae

402

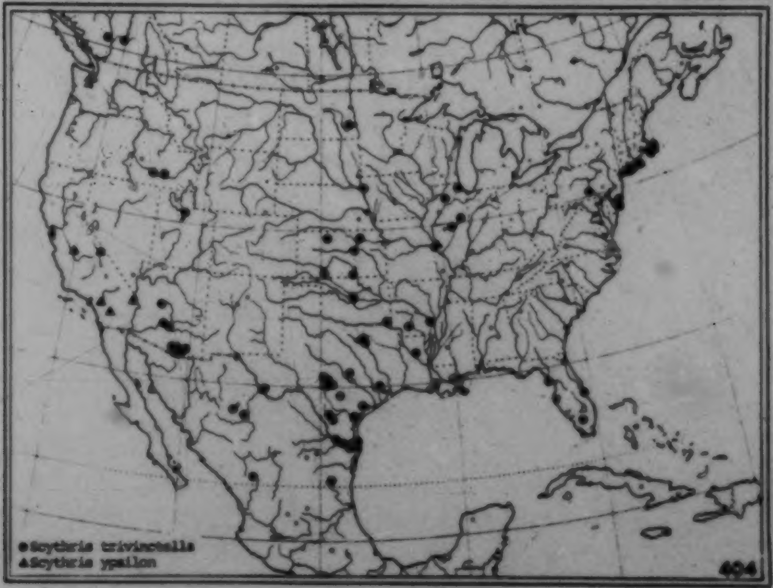
Figures 403 to 404. Known geographic distribution of scythridid species.

Figure 403. *Scythris immaculatella* (dots) and *Scythris limbella* (triangles) (only North American distribution shown for *S. limbella*).

Figure 404. *Scythris trivinctella* (dots) and *Scythris ypsilon* (triangles).


● Scythris immaculatella
▲ Scythris limbella

403


● Scythris trivinctella
▲ Scythris ypsilon

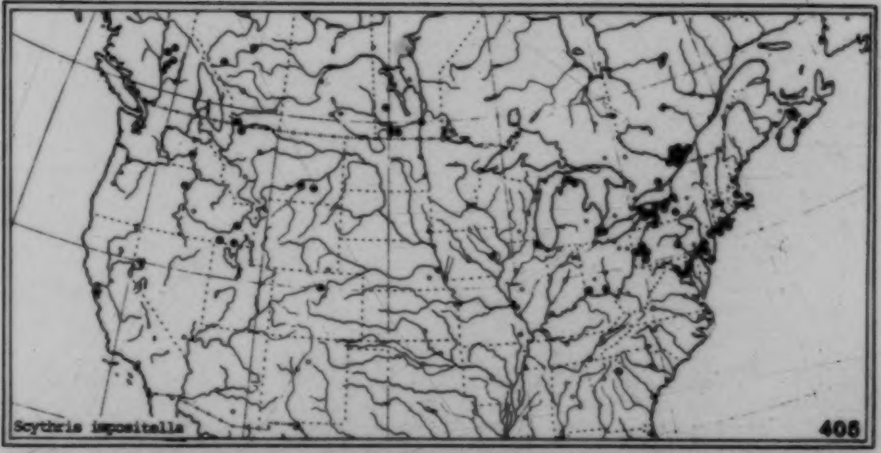
404

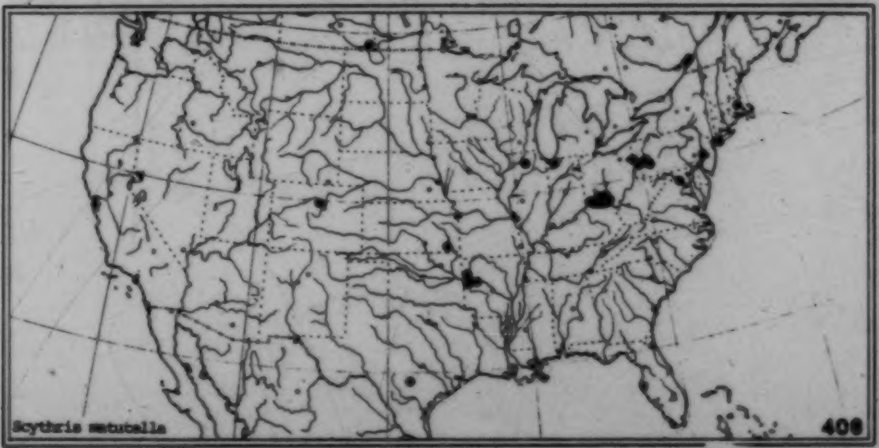
Figures 405 to 407. Known geographic distribution of scythridid species.

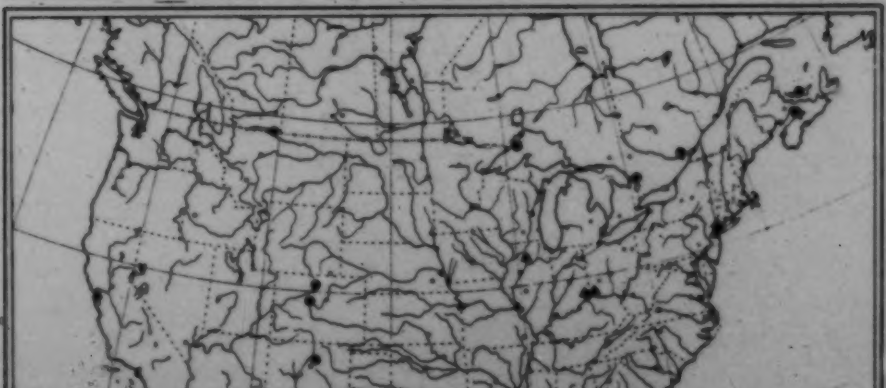
Figure 405. *Asymmetrura impositella* .

Figure 406. *Asymmetrura matutella* .

Figure 407. *Asymmetrura scintillifera* (dots) and *Asymmetrura graminivorella* (triangles).


Scythris impositella
405

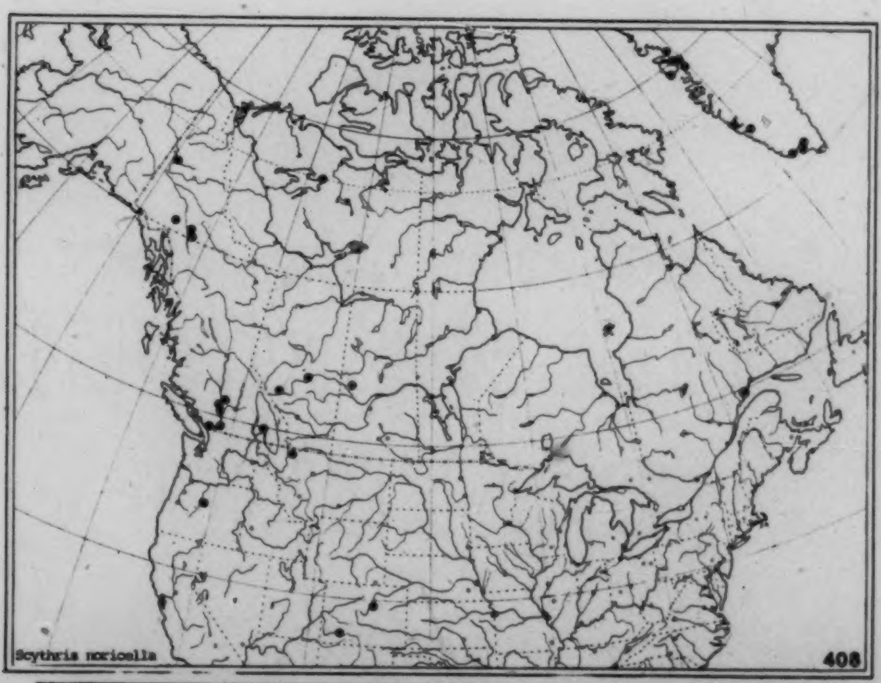

Scythris matutella
406

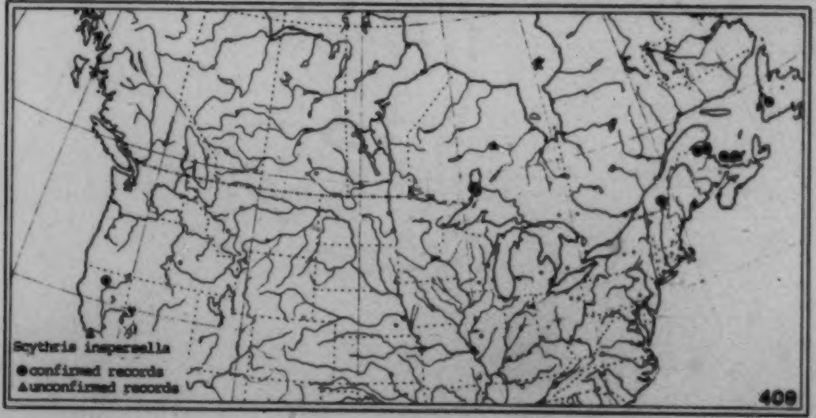

● Scythris scintillifera
▲ Scythris graminivorella
407

Figures 408 to 409. Known North American distribution of scythridid species.

Figure 408. *Scythris noricella* .

Figure 409. *Scythris inspersella* .

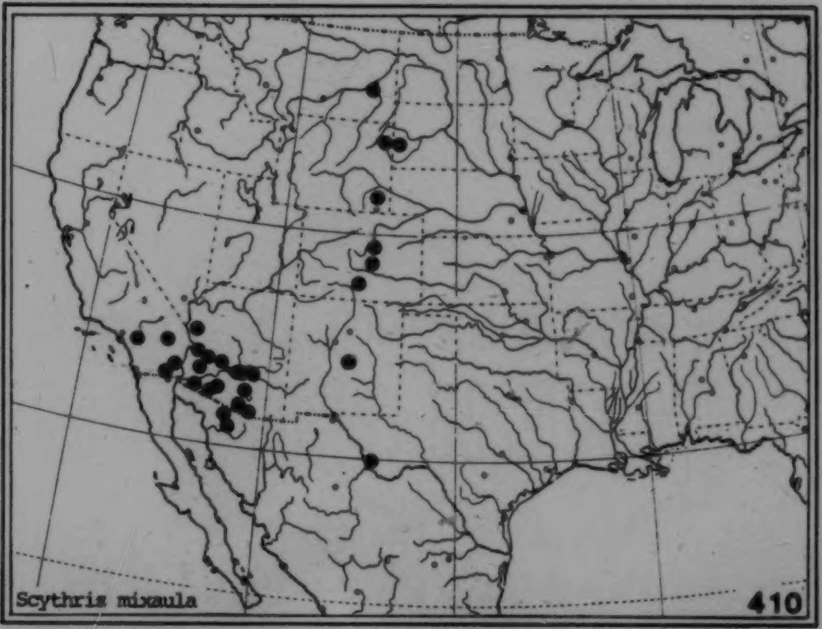

Scythris noricella
408

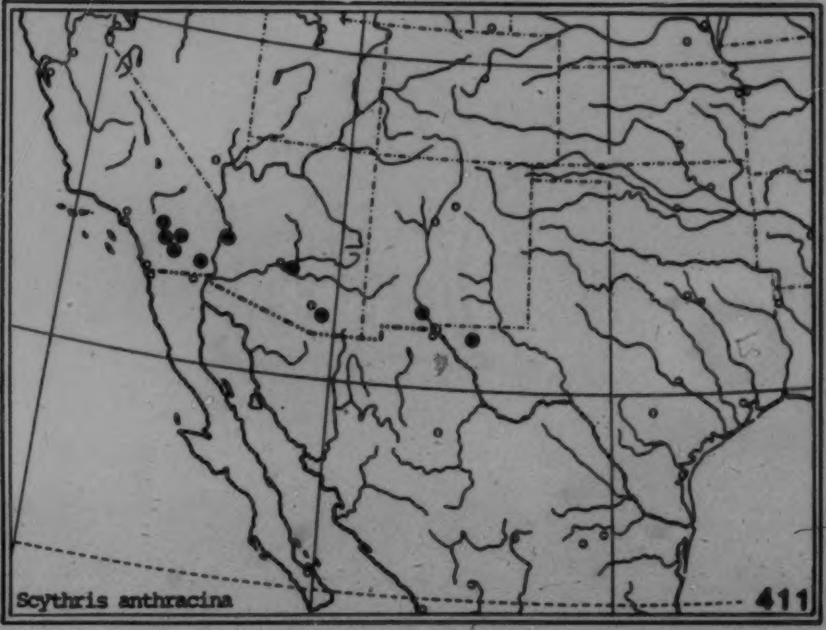

Scythris inspersella
● confirmed records
▲ unconfirmed records
409

Figures 410 to 411. **Known geographic distribution of scythridid species.**

Figure 410. ***Scythris mixaula*** **.**

Figure 411. ***Scythris anthracina*** **.**

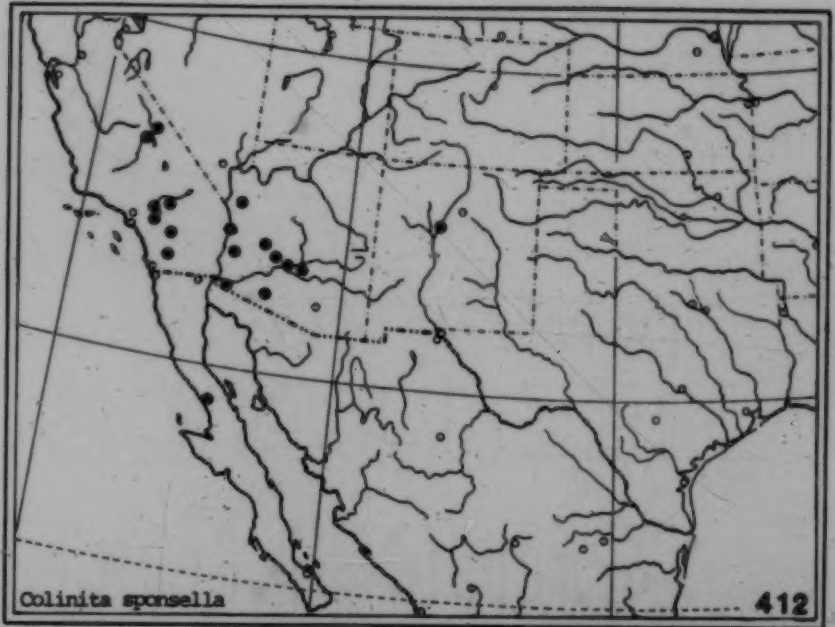

Scythris mixaula
410


Scythris anthracina
411

Figures 412 to 413. Known geographic distribution of scythridid species.

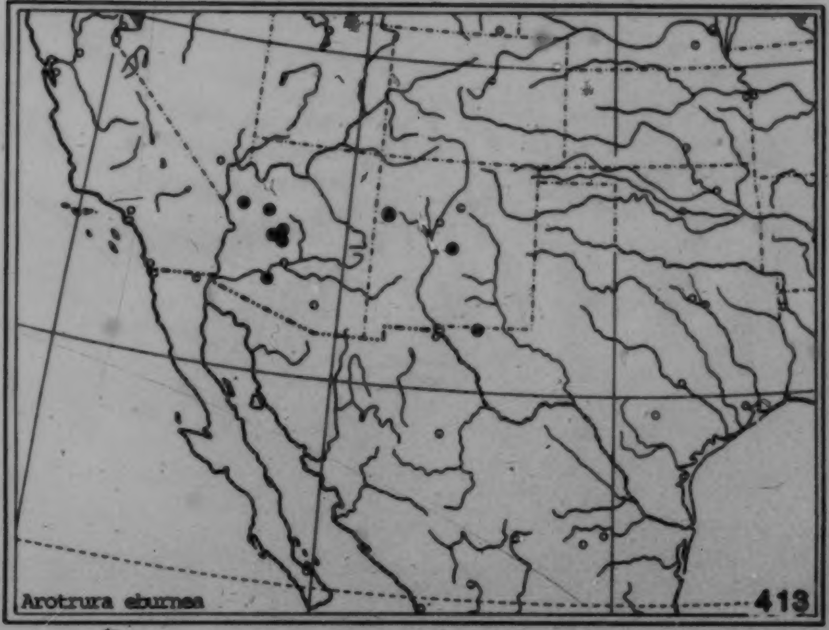
Figure 412. *Colinita sponsella* .

Figure 413. *Arotrura eburnea* .



Colinita sponsella

412



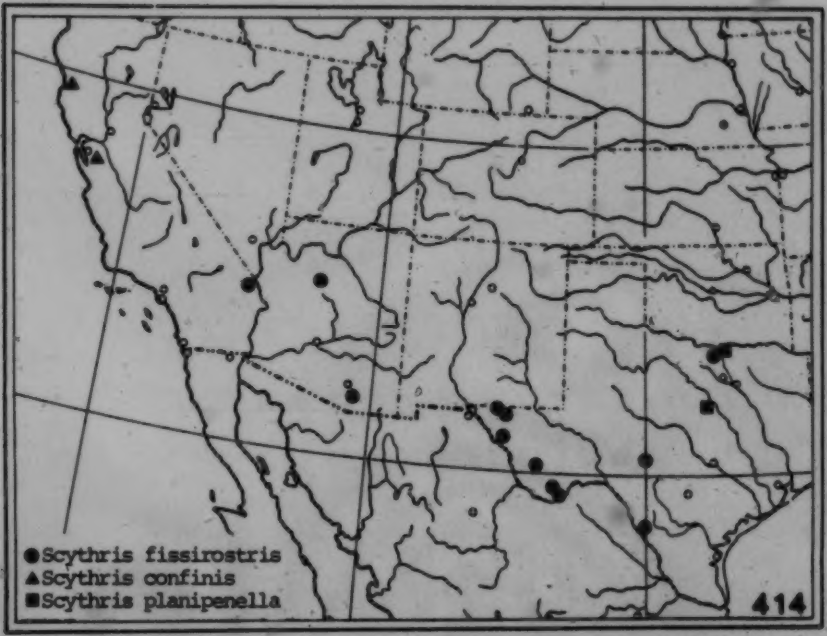
Arotrura eburnea

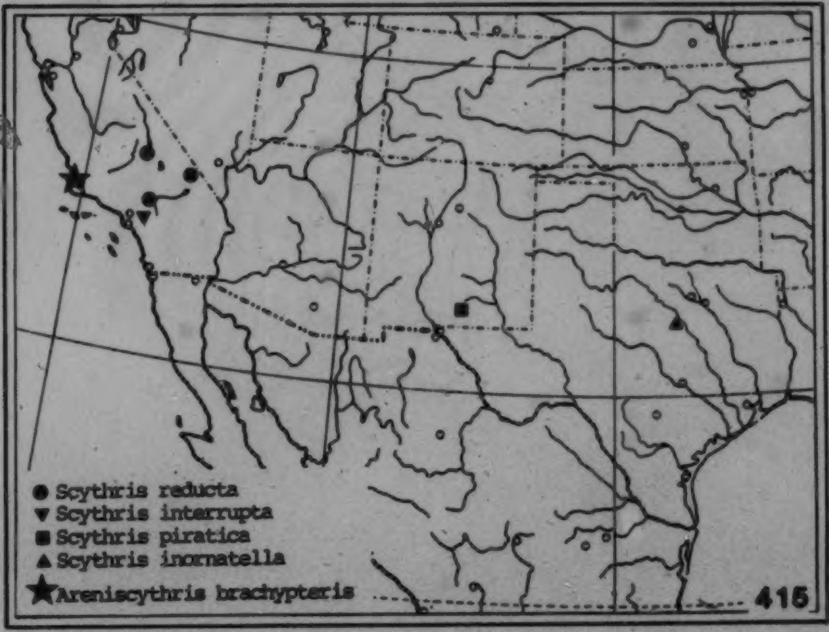
413

Figures 414 to 415. Known geographic distribution of scythridid species.

Figure 414. ***Neoscythris fissirostris*** **(dots),** ***Neoscythris confinis*** **(triangles) and** ***Neoscythris planipenella*** **(squares).**

Figure 415. ***Scythris reducta*** **(dots),** ***Scythris interrupta*** **(inverted triangle),** ***Scythris piratica*** **(square),** ***Scythris inornatella*** **(triangle), and** ***Areniscythris brachypteris*** **(star).**


● Scythris fissirostris
▲ Scythris confinis
■ Scythris planipenella
414

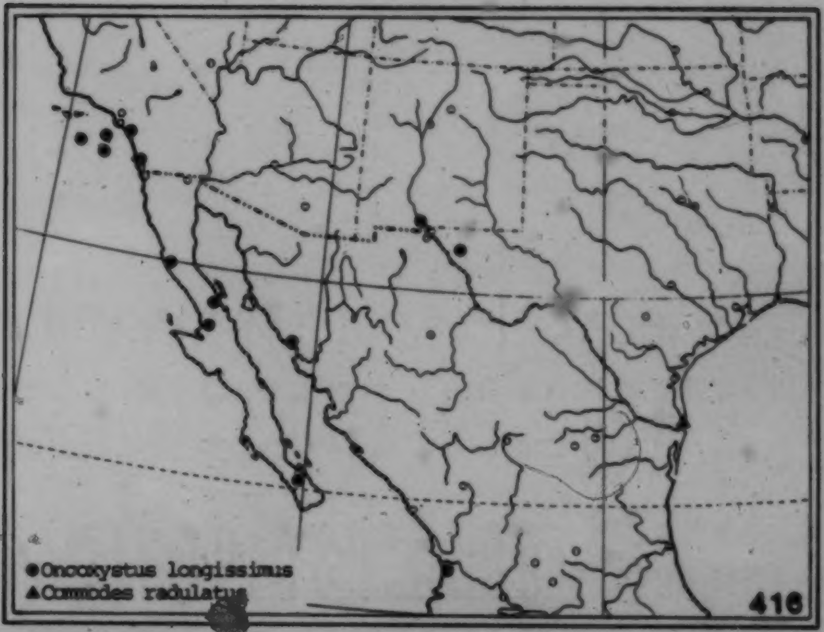

● Scythris reducta
▼ Scythris interrupta
■ Scythris piratica
▲ Scythris inornatella
★ Areniscythris brachypteris
415

Figures 416 to 418. Known geographic distribution of scythridid species.

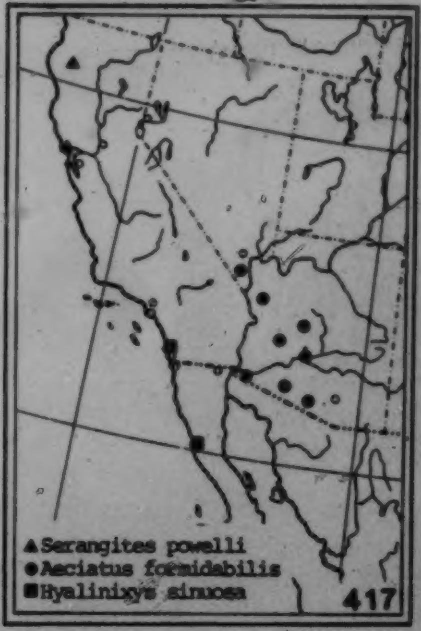
Figure 416. *Oncoxystus longissimus* (dots), and *Commodes radulatus* (triangle).

Figure 417. *Serangites powelli* (triangles), *Aeciatus formidabilis* (dots), and *Hyalinixys sinuosa* (squares).

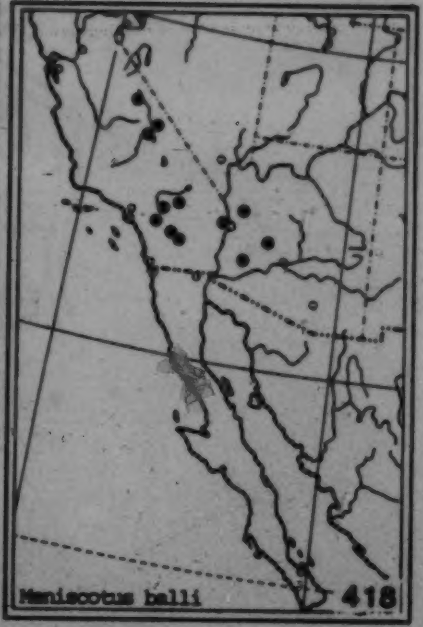
Figure 418. *Meniscotus balli* .


●Oncoxystus longissimus
▲Commodes radulatus

416


▲Serangites powelli
●Aeciatus formidabilis
■Hyalinixys sinuosa

417

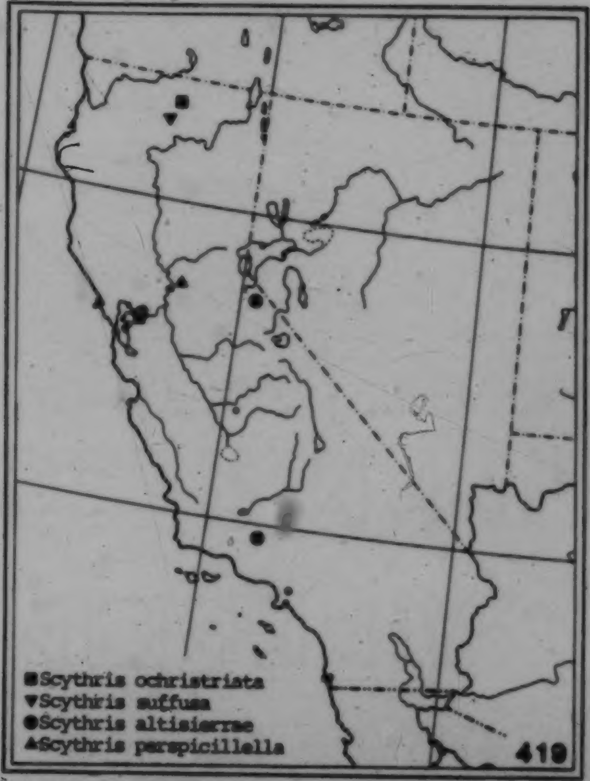

Meniscotus balli

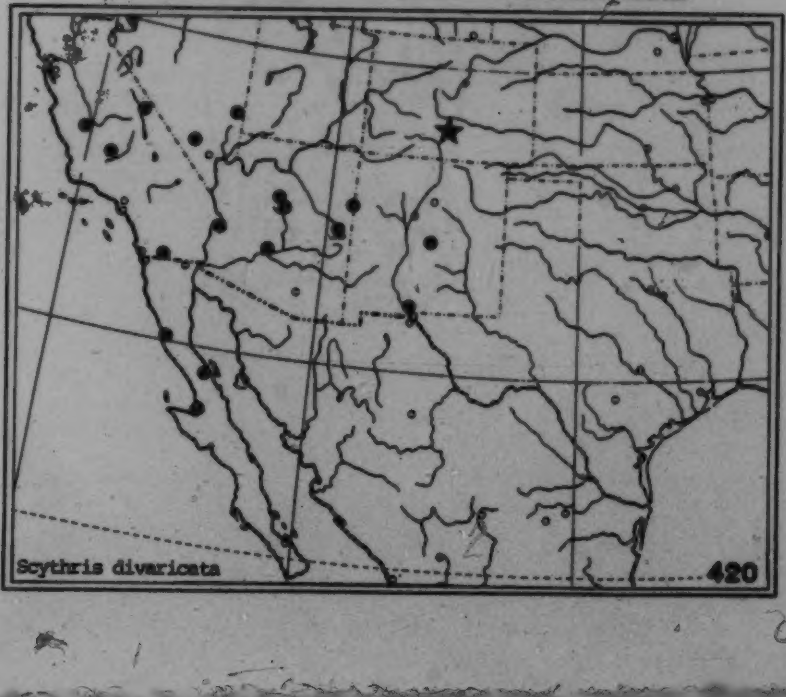
418

Figures 419 to 420. Known geographic distribution of scythridid species.

Figure 419. *Rhamphura ochristriata* (squares), *Rhamphura suffusa* (inverted triangle), *Rhamphura altisierrae* (dots), and *Rhamphura perspicillella* (triangle).

Figure 420. *Mimiella divaricata* (dots; star indicates state record).

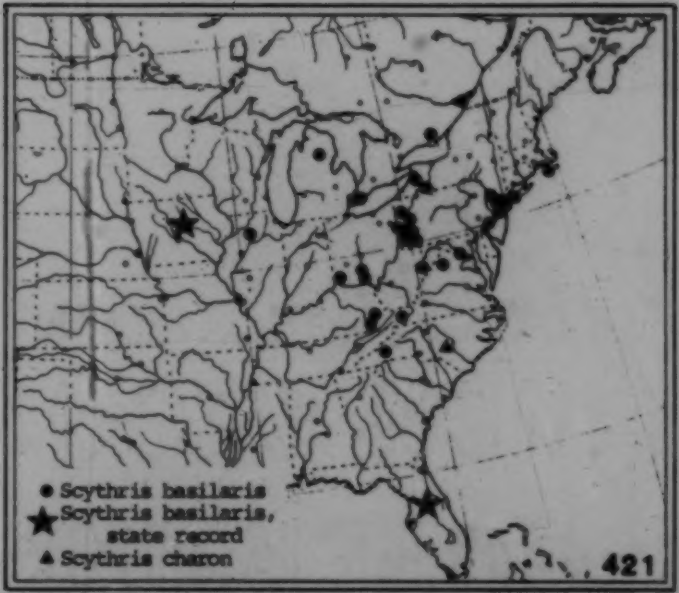

■Scythris ochristriata
▼Scythris suffusa
●Scythris altisierrae
▲Scythris perspicillella
419


Scythris divaricata
420

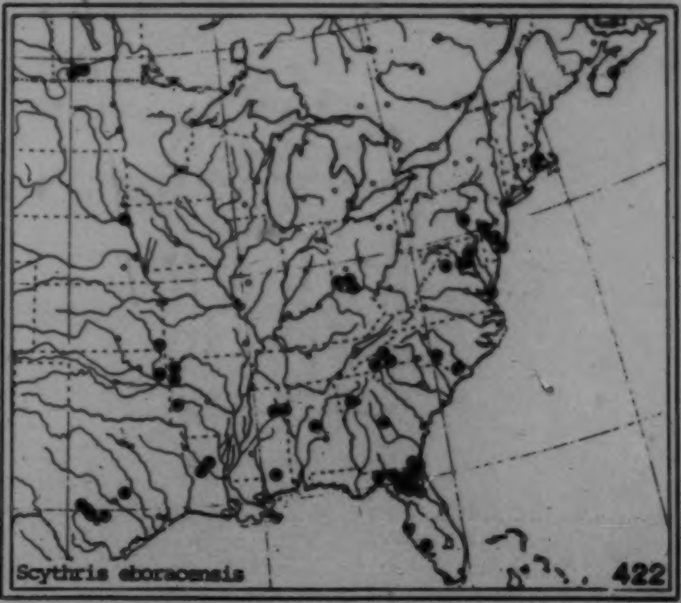
Figures 421 to 422. Known geographic distribution of scythridid species.

Figure 421. *Scythris basilaris* (dots and stars; stars indicate state record), and *Scythris charon* (triangle).

Figure 422. *Scythris eboracensis* .

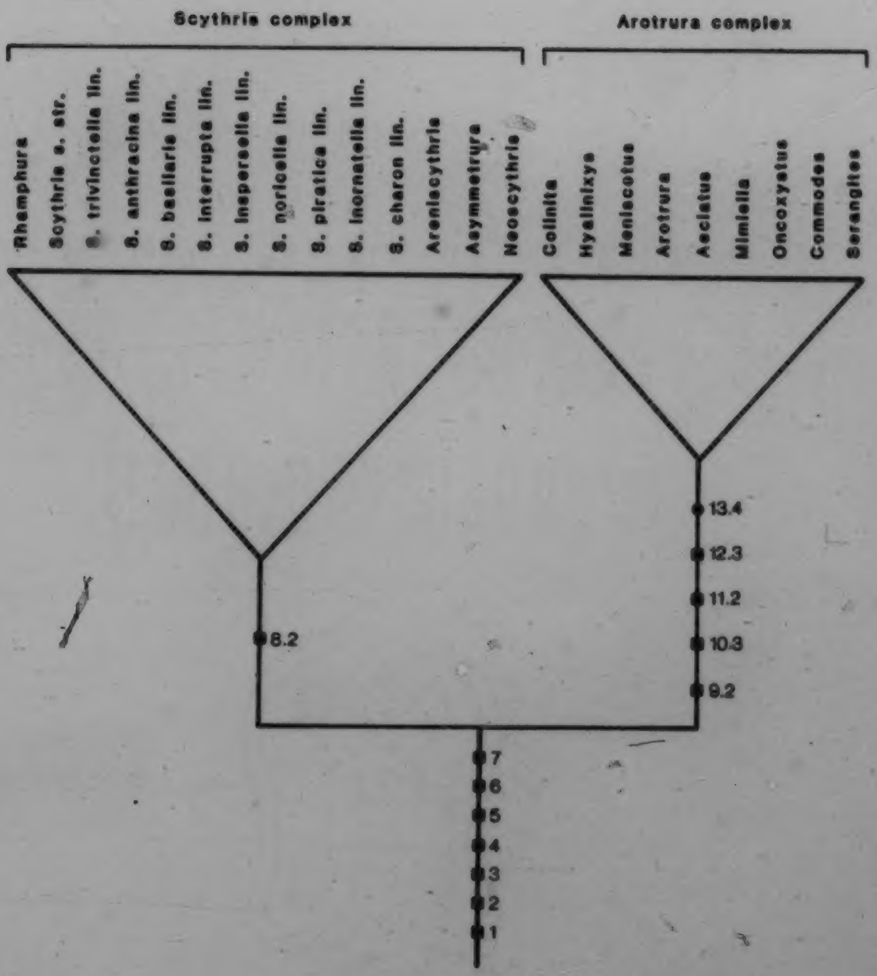

● Scythris basilaris
★ Scythris basilaris, state record
▲ Scythris charon

421


Scythris eboracensis

422

Figure 423. Cladistic relationships of the major complexes of scythridid genera and Nearctic species-group lineages. This hypothesis assumes that a frenum is apomorphic within the family. The numbered synapomorphies are explained in sections 5.2 and 5.3. "S." is the abbreviation for *Scythris* . Square dots indicate autapomorphies or non-homoplastic apomorphies. Round dots indicate homoplastic apomorphies.


Scythris complex
Arotrura complex
Rhamphura
Scythris s. str.
S. trivinctella lin.
S. anthracina lin.
S. basilaris lin.
S. interrupta lin.
S. inspersella lin.
S. noricella lin.
S. piratica lin.
S. inornatella lin.
S. charon lin.
Areniscythris
Asymmetrura
Neoscythris
Colinita
Hyalinixys
Meniscotus
Arotrura
Aeciatus
Mimiella
Oncoxystus
Commodes
Serangites
8.2
13.4
12.3
11.2
10.3
9.2
7
6
5
4
3
2
1

423

Figure 424. Different hypotheses of cladistic relationships of the Scythrididae, Lecithoceridae, and Gelechiidae, based on different interpretations of the frenum. Square dots indicate autapomorphies or non-homoplastic apomorphies. Round dots indicate homoplastic apomorphies.

(a) frenum synapomorphic for all three families;

(b) frenum synapomorphic for Lecithoceridae + Scythrididae +the single genus *Physoptila* ;

(c) frenum synapomorphic for Lecithoceridae + Scythrididae and homoplastic in the Gelechiidae (present in the single genus *Physoptila*).

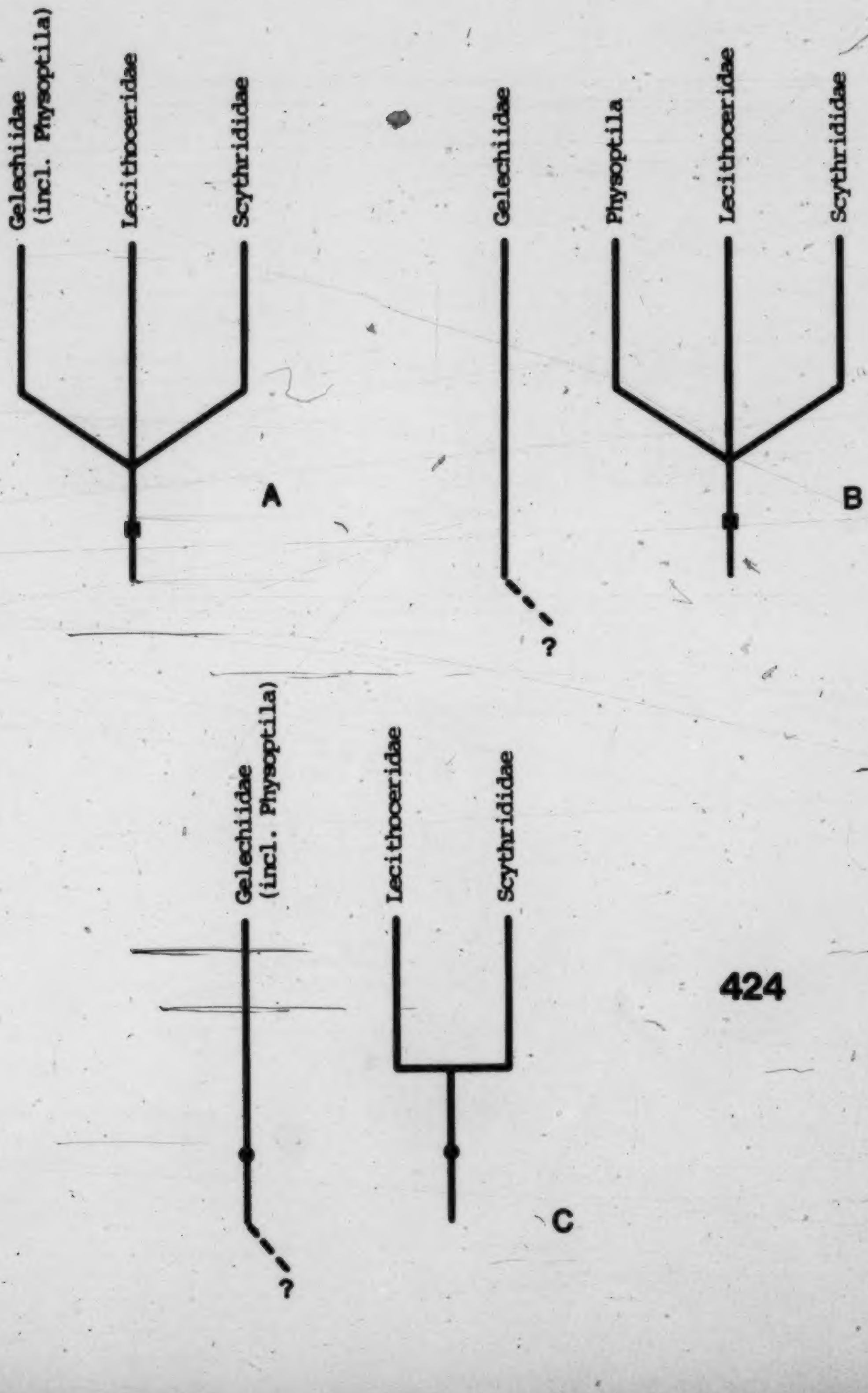

Gelechiidae (incl. Physoptila)
Lecithoceridae
Scythrididae
A
Gelechiidae
?
Physoptila
Lecithoceridae
Scythrididae
B
Gelechiidae (incl. Physoptila)
?
Lecithoceridae
Scythrididae
C

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Figure 425. Cladistic relationships of the genera and Nearctic species-group lineages of the *Scythris* complex. This hypothesis assumes that a frenum is apomorphic within the family. The numbered synapomorphies are explained in sections 5.2 and 5.3.1. Additional, unnumbered character states, not indicated on the cladogram, are also discussed in the text. Square dots indicate autapomorphies or non-homoplastic apomorphies. Round dots indicate homoplastic apomorphies. Numbers in brackets indicate that the character states occur only in some members of a clade/taxon. "S." is the abbreviation for *Scythris* .

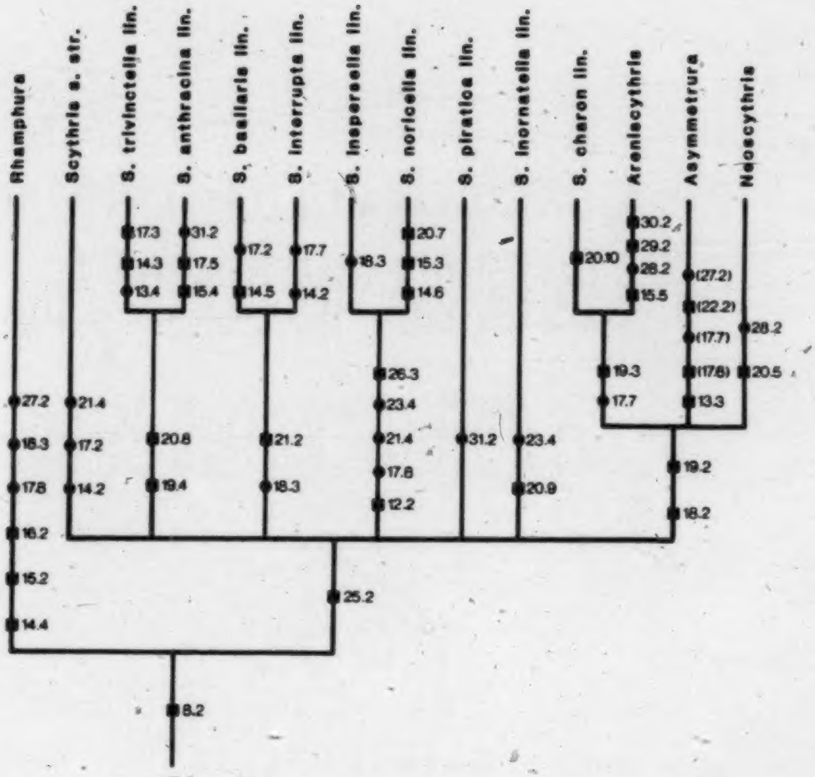
Rhamphura
Scythris s. str.
S. trivinctella lin.
S. anthracina lin.
S. basilaris lin.
S. interrupta lin.
S. inspersella lin.
S. noricella lin.
S. piratica lin.
S. inornatella lin.
S. charon lin.
Areniscythris
Asymmetrura
Neoscythris
17.3
14.3
13.4
31.2
17.5
15.4
17.2
14.5
17.7
14.2
18.3
20.7
15.3
14.6
20.10
30.2
29.2
28.2
15.5
(27.2)
(22.2)
(17.7)
(17.8)
13.3
28.2
20.5
19.3
17.7
26.3
23.4
21.4
17.6
12.2
27.2
18.3
17.8
16.2
15.2
14.4
21.4
17.2
14.2
20.8
19.4
21.2
18.3
31.2
23.4
20.9
19.2
18.2
25.2
8.2

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Figure 426. Alternative cladogram of relationships of the genera and Nearctic species-group lineages, assuming a frenum to be plesiomorphic within the family. Only synapomorphies of some lineages are indicated. Square dots indicate autapomorphies or non-homoplastic apomorphies. Round dots indicate homoplastic apomorphies. "S." is the abbreviation for *Scythris* .

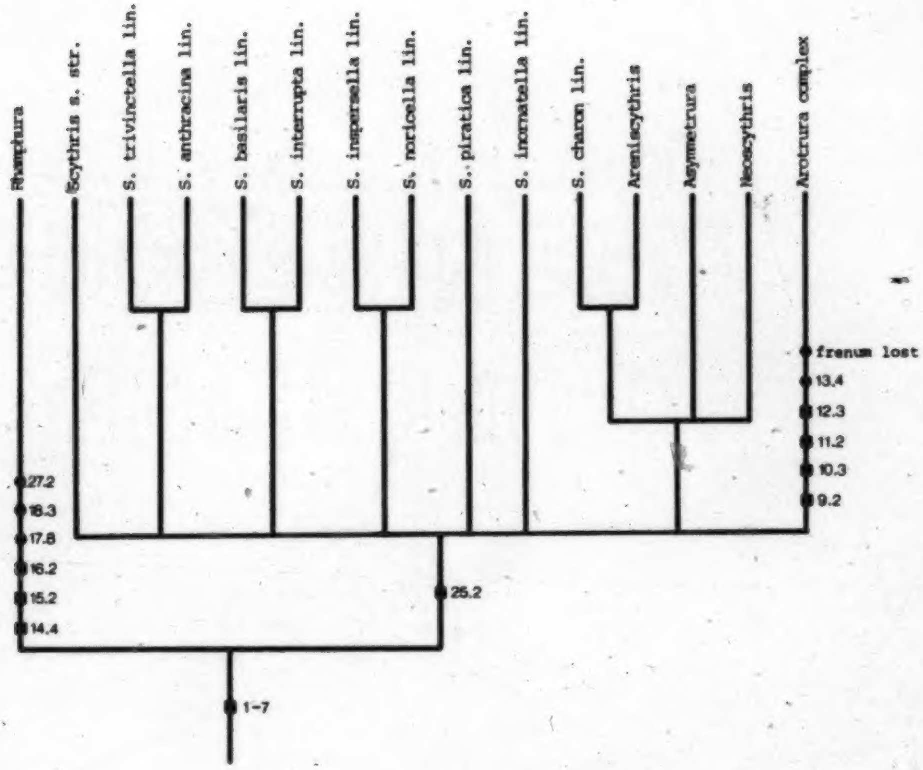
Rhamphura
Scythris s. str.
S. trivinctella lin.
S. anthracina lin.
S. basilaris lin.
S. interrupta lin.
S. inspersella lin.
S. noricella lin.
S. piratica lin.
S. inornatella lin.
S. charon lin.
Areniscythris
Asymmetrura
Neoscythris
Arotrura complex
frenum lost
13.4
12.3
11.2
10.3
9.2
27.2
18.3
17.8
16.2
15.2
14.4
25.2
1-7

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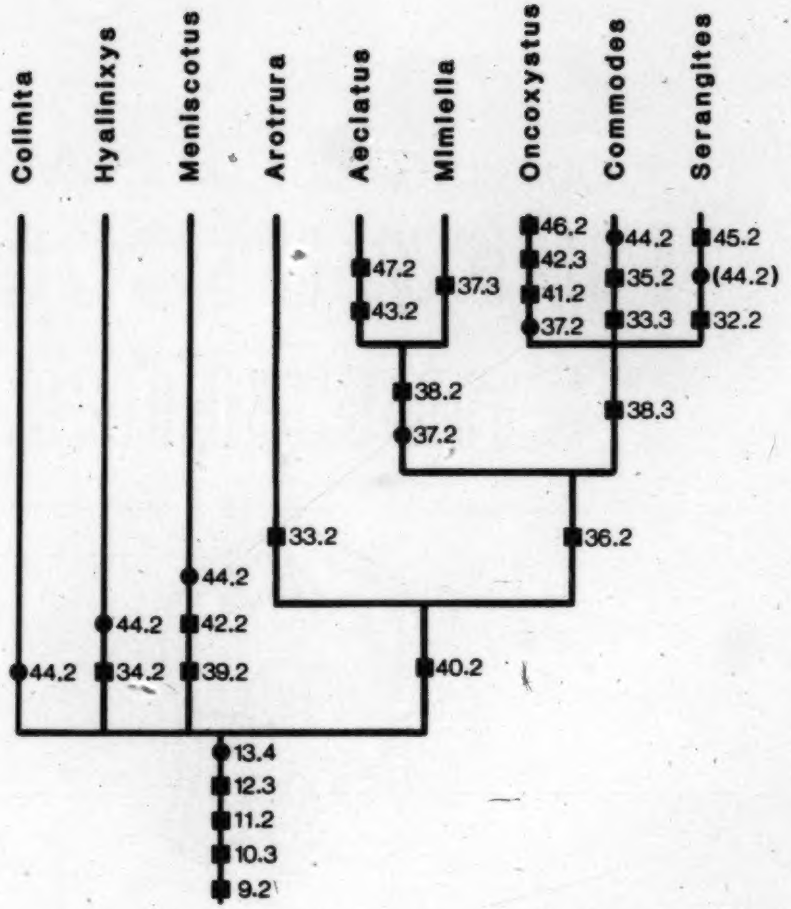
Figure 427. Cladistic relationships of the genera of the *Arotrura* complex. The numbered synapomorphies are explained in sections 5.2 and 5.3.2. Square dots indicate autapomorphies or non-homoplastic apomorphies. Round dots indicate homoplastic apomorphies. Numbers in brackets indicate that the character states occur only in some members of a clade/taxon. Additional, unnumbered character states, not indicated on the cladogram, are also discussed in the text.


Collinita
Hyalinixys
Meniscotus
Arotrura
Aeclatus
Mimiella
Oncoxystus
Commodes
Serangites
46.2
42.3
41.2
37.2
44.2
35.2
33.3
45.2
(44.2)
32.2
47.2
43.2
37.3
38.2
37.2
38.3
33.2
36.2
44.2
44.2
42.2
44.2
34.2
39.2
40.2
13.4
12.3
11.2
10.3
9.2

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